RECORD OF SOCIETY OF ACTUARIES
1990 VOL. 16 NO. 3

PRODUCT FEATURES VERSUS INVESTMENT POLICY

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o The days of static, current yield driven pricing and product design are rapidly being replaced by dynamic, total return management. Matching product design to investment strategy has become critical to risk management and competitive posturing. This session will include discussion of:
-- Academic review of duration, convexity, and stochastic scenario simulation
-- Liability option adjusted spreads versus asset option adjusted spreads
-- Use of total return from equity investments to support insurance products

MR. REED P. MILLER: I'm with Lincoln National Corporation and the topic of our panel is Product Features Versus Investment Policy. I've tried to structure this in such a way that it will flow. The first two panelists will flow kind of in combination and then a third, but related topic, will be covered by the third panelist. I believe I have arranged a panel that includes three well-qualified individuals to discuss what I think are some real leading-edge ideas and approaches to dealing with product pricing, product feature design, and connecting that with the investment part of the process.

The first speaker will be Mr. David F. Babbel, Associate Professor at the Wharton School, who will be focusing on the academic review. The second speaker will be Mr. Thomas A. McAvity, Jr., who is Vice President and Director of Quantitative Research for Lincoln National Corporation, or more particularly, within Lincoln National Investment Management Company, which is the operation that does all the investing for Lincoln National. Mr. McAvity will be taking some of the materials as related by Mr. Babbel and relating them specifically to a more real-world situation and application, using liability option-adjusted spreads and asset option-adjusted spreads as a means of pricing and managing products. The third speaker is Mr. James F. Reiskytl, who is Vice President of Tax and Financial Planning at Northwestern Mutual Life (NML). He will be focusing on the use of total return from equity investments to support insurance products. And lastly is Mr. Jeffrey K. Dellinger, who is Assistant Vice President and Actuarial Director of Lincoln National's Savings Products and Individual Annuity Operations.

* Mr. Babbel, not a member of the sponsoring organizations, is Associate Professor of Insurance and Finance, the Wharton School of University of Pennsylvania in Philadelphia, Pennsylvania.

** Mr. McAvity, not a member of the sponsoring organizations, is Vice President and Director of Quantitative Research at Lincoln National Investment Management Company in Fort Wayne, Indiana.

PANEL DISCUSSION

MR. DAVID F. BABBEL: Most insurance policies and nearly all assets held by insurers have interest-sensitive cash flows. By "interest-sensitive" I mean that the amounts and/or timing of the cash flows are related to interest rates. They may be related contemporaneously, or with a lead or lag. They may exhibit high or low correlations with interest rates. But unless the correlations are zero, they are categorized as "interest-sensitive." This simple observation has far-reaching implications with regard to appropriate valuation technology, product pricing, and asset/liability management.

To give some examples, consider first common stocks. The cash flows and growth rates to the companies that issue them are obviously linked to interest rate levels. Most companies have higher net cash flows when interest rates rise, but this increase is usually insufficient to fully compensate for the increase in rates used for discounting the cash flows. Accordingly, the market values of stocks decline about twice as much, on average, in percentage terms, as a rise in interest rates. We would say, therefore, that common stocks exhibit a duration of approximately 2. Clearly, duration explains only a small portion of the movements in common stock values. Nevertheless, a valid measure of duration will take into account the interest sensitivity of the cash flows. (If interest sensitivity of common stock cash flows were ignored, one would compute a duration measure somewhere between 20-30%, on average, for each percentage point change in interest rates.)

Consider bonds. Virtually all bonds other than noncallable Treasuries and default-free zero coupon bonds exhibit interest-sensitive cash flows. Floating rate notes are clear examples. Callable corporate and municipal bonds also exhibit interest-sensitive cash flows, as the timing of repayment of principal will be accelerated if interest rates decline enough. Other option-like elements of corporate bonds, such as sinking funds with doubling-up provisions, impart interest sensitivity to the cash flows. Even straight noncallable corporate bonds exhibit some interest-sensitive cash flows, as the likelihood of default is influenced by interest rates.

Consider mortgages or mortgage-backed securities. Prepayments of principal on these contracts are closely tied to interest rates. Consider interest rate options, futures, caps, and floors. Payments are contractually linked to interest rates. Real estate returns are also related to interest rates. In sum, nearly all assets that are traditionally held by insurers exhibit interest-sensitive cash flows.

How about insurance liabilities? In the property/casualty industry, any insurance policy whose payouts are related to inflation will exhibit interest-sensitive cash flows, due to the relationship between interest rates and inflation.

In the life/health industry, the interest sensitivity is often even stronger. Not only the amounts of variable insurance payouts (e.g., health benefits, annuity and universal life [UL] crediting rates, and life insurance policy dividends) are related to interest rates, but also the timing of fixed contractual payouts (e.g., death benefits, surrender cash values) is related to interest rates. The reason for the latter group of payouts to have interest sensitivity is that the policyholder possesses options (e.g., lapse, policy loans), and the frequency of exercise of these options is related to interest rates. For example, policyholders tend to surrender their policies or let them lapse more frequently when interest rates are rising. This is particularly true when an insurer offers a portfolio yield, or a fixed rate of return on its polices. What kind of policyholders take their money elsewhere under such circumstances? Typically, the healthier ones. We have found that mortality rates, and therefore the incidence of payment of death benefits, are related to lapse rates occasioned by interest rate swings. Window GICs are another example of interest-sensitive cash flows.

While I could belabor the point with other examples, suffice it to say that most policies issued by insurers have interest-sensitive cash flows.

The earliest financial models attempted to derive present values by discounting expected cash flows by spot and forward interest rates (plus a spread of risk) implicit in the prevailing yield curve. Later, approximately three decades ago, the Nobel laureates Kenneth Arrow and Gerard Debreu suggested that the value of a cash payment would depend on the "state of nature" in which it was paid or received. For example, a given amount of cash to be received in the future would be worth far less, in terms of purchasing power, if it were to be received after an inflationary bout (i.e., postinflationary state of nature) than it would be worth in a deflationary environment. Their paradigm was dubbed "State Preference Theory" and has served as a foundation from which modern valuation technology has evolved.

An application of state preference theory is provided in Chart 1. The top half of the exhibit portrays a riskless investment that returns $1 regardless of which state of nature transpires. The value of the dollar (i.e., discount factor) depends, however, on whether it is received in state 1 or state 2. This state-dependent value may simply be a reflection of the dollar's purchasing power in each state, or it may be the result of a combination of factors. The riskless investment is worth $0.896, according to my calculation.

CHART 1

State	Return Xi	Probability of State Ps	Xi * Ps	Value of One Dollar in Alternative States Ys	Xi*Ps*Ys
Value of a Riskless Cash Flow					
1	1.00	0.3	0.30	0.70	0.21
2	1.00	0.7	0.70	0.98	0.686
			1.00		0.896
Value of a Risky Cash Flow					
1	0.800	0.3	0.24	0.70	0.168
2	1.086	0.7	0.76	0.98	0.745
			1.00		0.913

The lower half of Chart 1 shows the value of a risky investment, whose nominal returns depend on what state of nature actually emerges. If state 1 occurs, $0.80 is received; if state 2 occurs, \$1.086 is received. After factoring in the probabilities of the states occurring, we find that the expected nominal return on this investment is \$1, equal to the certain return provided by the riskless investment. Note that the present value of \$0.913 is higher than that of the riskless investment. This higher value may appear counter-intuitive at first, as we traditionally associate lower values (and higher discount rates) with risky investments. However, examination of the pattern of cash flows reveals the riskier investment to provide relatively more of its payoff in state 2, where money is valued more highly.

More recent models of valuation have relied on arbitrage-free relationships and put-call parity that are expected to characterize an efficient capital market. Analogous to the state-dependent discount rates of the Arrow/Debreu model, the arbitrage pricing models approach the valuation of cash flow by discounting it with the series of interest rates that could give rise to the cash flow. In the case of a cash flow whose timing and magnitude are independent of interest rate paths, the same value can be derived by simply discounting it with the appropriate spot rate from the term structure of interest.

To illustrate these concepts in a simplified, yet concrete way, consider Chart 2. Suppose that the one-year interest rate (one-year spot rate) is 8.0%. Suppose further that we would like to value a zero coupon Treasury that pays \$1,000 at the end of five years. Finally, suppose that interest rates will change from their 8% level to either 12% or 4%, with equal probability,* at the end of the year, and remain at the new level throughout the remainder of five-year period. Modern valuation theory and practice would have us take the \$1,000 future payment and discount it by each sequence of single-period interest rates that could prevail in the future. We call this discounting by interest rate paths. Under the simplified assumptions in this case, we would discount the \$1,000 by the 8%, and then either by the sequence of four 12% rates or by the sequence of four 4% rates. Weighting the resultant path-dependent present values across the two states will then give us the appropriate market value, \$689.96. To determine the five-year spot rate of interest, we simply take the promised value at maturity, divide it by the appropriate market value just calculated, take the fifth root, and subtract 1. Our resulting spot rate, sometimes referred to as the zero coupon rate, is 7.7047%.

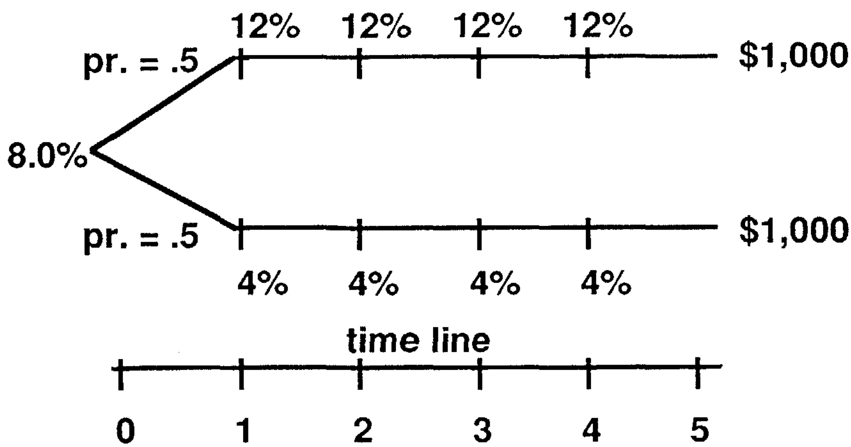
We could proceed similarly to compute the value of a four-year zero coupon investment and the four-year spot rate of interest. To accomplish this, assume that the \$1,000 payment is received at the end of four years rather than five years. All other conditions are as before (Chart 3). We then discount the \$1,000 by the two shorter (by one period) interest rate sequences and average the path-dependent present values, as before, to get the market value. Then taking the fourth root of the maturity value divided by the market value, and subtracting 1, we derive the four-year spot rate.

The same process can be used to derive the entire term structure of interest (Chart 4). The downward slope to the interest rate is explained by the asymmetry in value changes produced from an equivalent increase in interest rates.

* The technical term used in these approaches to valuation is "risk-neutral probabilities." See Pedersen, Shiu, and Thorlacius, "Arbitrage-Free Pricing of Interest Rate-Contingent Claims." *TSA*, Volume 41, pp. 231-279.

CHART 2

Discounting by Interest Rate Paths



Question: What would a "5-Year Zero Coupon" be worth if interest rates were to follow these kinds of paths?

$$\$1{,}000 \div \{(1.08)(1.12)(1.12)(1.12)(1.12)\} = \$588.44$$

$$\$1{,}000 \div \{(1.08)(1.04)(1.04)(1.04)(1.04)\} = \$791.49$$

$$\{\$588.44 \times 0.5\} + \{\$791.49 \times 0.5\} = \$\underline{689.96}$$

5-Year Spot Rate of Interest:

$$\sqrt[5]{1{,}000 \div 689.96} - 1 = \underline{7.7047}\%$$

CHART 3

Determining Implied Spot Rates

Question:

What would the entire term structure of interest rates look like under these volatility conditions?

Answer:

Since we have already computed the 5-yr rate, we simply follow the same procedure, except that we assume the \$1,000 final payment occurs earlier than the 5th year.

If the payment were to be received in 4 years, its market value would be computed to be:

$$\$1{,}000 \div \{(1.08)(1.12)(1.12)(1.12)\} = \$659.06$$

$$\$1{,}000 \div \{(1.08)(1.04)(1.04)(1.04)\} = \$823.14$$

$$\{\$659.06 \times 0.5\} + \{\$823.14 \times 0.5\} = \$\underline{741.10}$$

4-Year Spot Rate of Interest:

$$\sqrt[4]{1{,}000 \div 741.10} - 1 = \underline{7.7782}\%$$

CHART 4

Eliciting the Term Structure from Prices

Continuing in a similar pattern, we would compute the entire term structure to be:

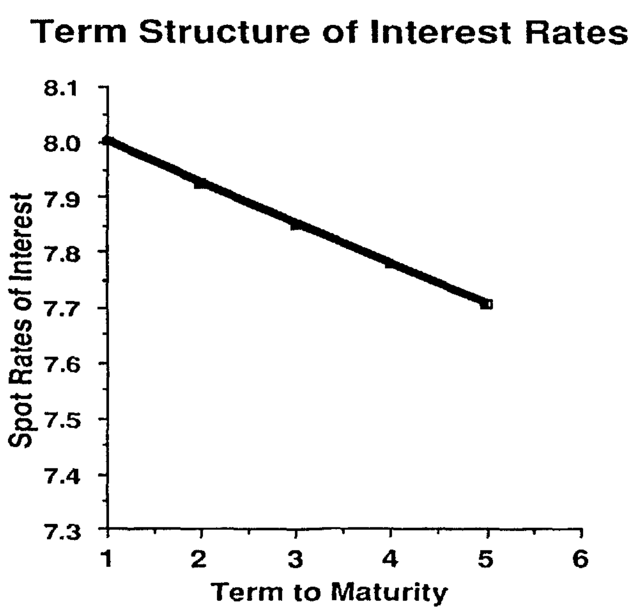
5-Year Spot Rate = 7.7047 %

4-Year Spot Rate = 7.7782 %

3-Year Spot Rate = 7.8519 %

2-Year Spot Rate = 7.9259 %

1-Year Spot Rate = 8.0000 %



Averaging these prices together results in a higher mean value than that associated with no move in interest rates; consequently, the spot rates of interest are lower.

Note that the same market prices of zero coupon bonds may be estimated using either of the two methods: discounting cash flows by spot rates of interest or discounting cash flows by sequences of single-period interest rates along all interest rate paths and averaging the resultant path-dependent present values. While the first method seems to be far simpler, it ends up that the second method can be used under many more circumstances. In particular, it is adept at estimating market values of cash flows that have interest sensitivity.

Consider a situation similar to that described earlier, except that the actual size of the cash flow five years hence is dependent on the future interest rate level. If interest rates go to 12%, the payment is $1,500. If rates go to 4%, the payment is $500 (Chart 5). Even though the expected cash flow is the same, the payment is default free, and the interest rate paths are identical to those specified earlier, the market value of the interest-sensitive zero coupon bond is $639.20, quite a bit lower than the $689.20 computed earlier. It would be erroneous to compute the value of such an interest-sensitive investment by discounting its expected cash flow at the five-year spot rate of interest. The error would be 7.94% in magnitude. However, having determined the appropriate price, we would compute its "yield to maturity" (YTM) by dividing the final expected value ($1,000) by the market price ($639.20), taking the fifth root, and subtracting 1. The resulting YTM would be 9.3634%.

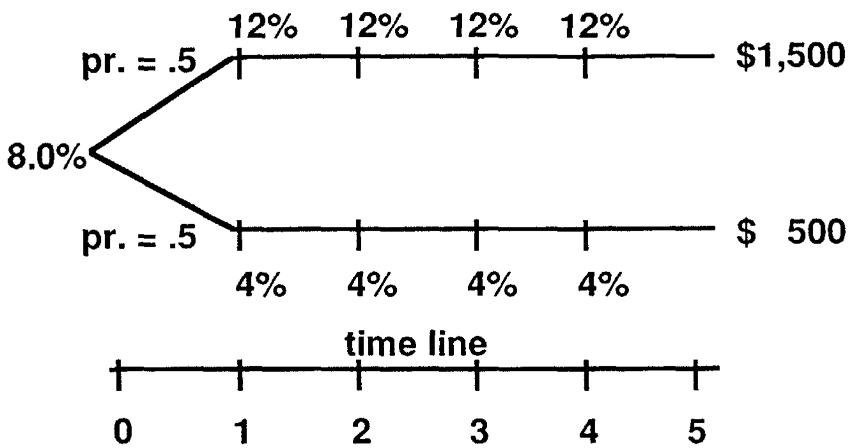
Now let's reverse the pattern of the cash flows, so that the smaller sum is received if interest rates go up and the larger sum if they go down (Chart 6). Proceeding as before, we would estimate market value to be $740.72 and YTM to be 6.1863%. The estimated market value is 7.36% higher than would have been estimated by mistakenly using the five-year spot rate of interest to discount the expected cash flow of $1,000.

Note how the two interest-sensitive zero coupon bonds have such disparate YTMs (6.1863% versus 9.3634%) and wide-ranging market values ($740.72 versus $639.20, roughly 16% apart), even though both are default free, both have the same expected cash flow of $1,000, and both are valued using identical interest rate paths. To illustrate the problem of focusing on yield spreads, as is traditional in insurance, an insurer may issue liabilities like the second interest-sensitive zero mentioned in Chart 6 costing (yielding to the consumer) 6.1863% and fund it with assets like the first interest-sensitive zero coupon bonds described in Chart 5 yielding 9.3634%. The yield spread of approximately 318 basis points might be considered to be "locked in" because the asset and liability portfolios are duration-matched at 5.0 -- the insurer would go bankrupt. No amount of pooling of similar risks will ameliorate the situation either. Only hedging the liabilities with similarly behaved assets can address the risk.

Having demonstrated the impact of interest sensitivity of cash flows on yields, we can go on to investigate the effect of interest rate volatility on yields. To do so, we will hold unchanged the maturity value, as at first, at $1,000, regardless of interest rate path. However, we will decrease our volatility estimate by one half. Thus, future interest rates will either go up to 10% or down to 6% (Chart 7).

CHART 5

What if Cash Flow Amounts are Related to Future Interest Rate Levels?



Question: What would a "5-Year Contingent Claim" be worth if interest rates were to follow these kinds of paths?

$$\$1{,}500 \div \{(1.08)(1.12)(1.12)(1.12)(1.12)\} = \$882.66$$

$$\$\ 500 \div \{(1.08)(1.04)(1.04)(1.04)(1.04)\} = \$395.74$$

$$\{\$882.66 \times 0.5\} + \{\$395.74 \times 0.5\} = \$\underline{639.20}$$

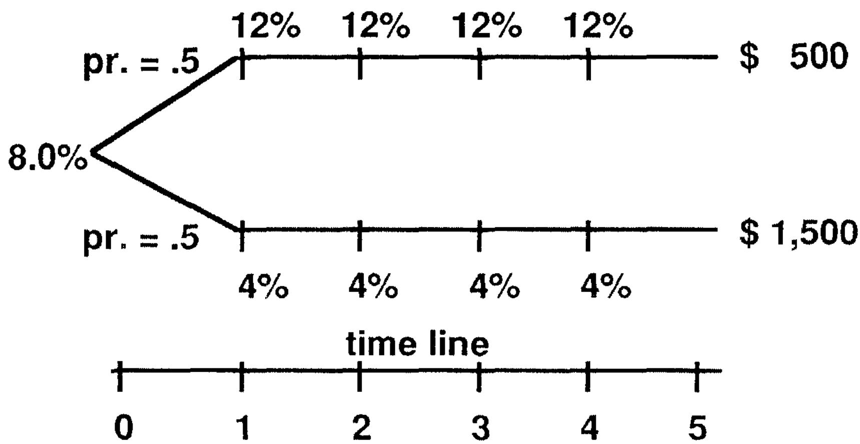
$$\$639.20 \neq \$689.96 \qquad (\text{ Error is } 7.94\%)$$

The 5-Year Implied "Yield" would be:

$$\sqrt[5]{1{,}000 \div 639.20} - 1 = 9.3634\%$$

CHART 6

Now, let's reverse the cash flow pattern, while maintaining the same expected value



Question: What would a "5-Year Contingent Claim" be worth if interest rates and cash flows were to follow this kind of pattern?

$\$\ \ 500 \div \{(1.08)(1.12)(1.12)(1.12)(1.12)\} = \$\ \ 294.22$

$\$1{,}500 \div \{(1.08)(1.04)(1.04)(1.04)(1.04)\} = \$1{,}187.23$

$\{\$294.22 \times 0.5\} + \{\$1{,}187.23 \times 0.5\} = \$\underline{740.72}$

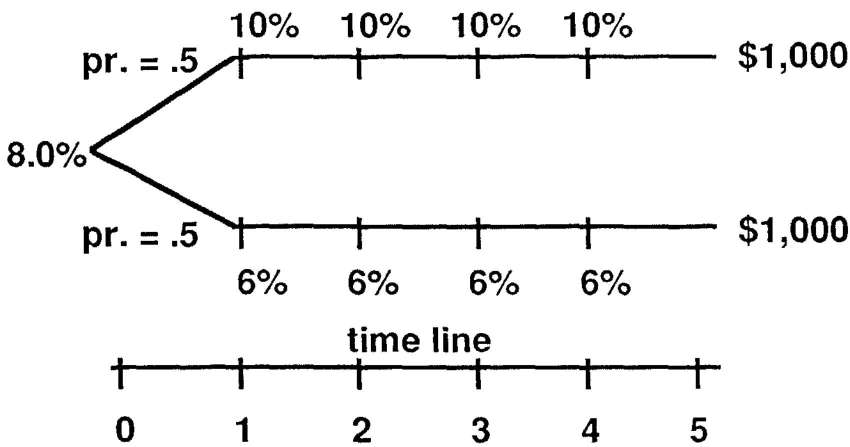
$\$740.72 \neq \$689.96$ (Error is 7.36%)

The 5-Year Implied "Yield" would be:

$$\sqrt[5]{1{,}000 \div 740.72} - 1 = 6.1863\%$$

CHART 7

Reducing Volatility:



Question: What would a "5-Year Zero Coupon" be worth if interest rates were to follow these kinds of paths?

$$\$1{,}000 \div \{(1.08)(1.10)(1.10)(1.10)(1.10)\} = \$632.42$$

$$\$1{,}000 \div \{(1.08)(1.06)(1.06)(1.06)(1.06)\} = \$733.42$$

$$\{\$632.42 \times 0.5\} + \{\$733.42 \times 0.5\} = \$\underline{682.92}$$

5-Year Spot Rate of Interest:

$$\sqrt[5]{1{,}000 \div 682.92} - 1 = \underline{7.9260}\,\%$$

Under these circumstances, a five-year zero coupon bond would be worth $682.92 and the five-year spot rate of interest would be 7.926%.

Proceeding as before, we can derive the entire term structure of interest. The results of this exercise are given in Chart 8. Note that the lower volatility results in higher spot rates of interest along the entire term structure. This finding is consistent with the asymmetry of discounting, discussed earlier. However, increased volatility cannot always be assumed to lower yield, as it did with the simple additive interest rate process assumed above. The impact of volatility on yields will depend on the nature of the stochastic interest rate process.

To demonstrate this last point, let us consider a richer set of interest rate paths through the vehicle of a binomial tree. This time we will let interest rates evolve in a multiplicative fashion, asymptotically approaching a log-normal distribution. This particular pricing tree using a log-normal interest rate assumption, is perhaps the most widely used model today (Chart 9). Note how, instead of two simple paths, we generate an entire array of paths, whose probabilities of realization are given by Pascal's triangle. For simplicity I have assumed annual multiplicative changes in short-term interest rates, although in practice one usually assumes monthly or even shorter periods between interest rates moves.

Using the same methodology as described in Chart 2-4, I have computed the spot rate term structures implicit in the binomial tree for two different levels of volatility: 10% and 20% (Chart 10). Note how the higher volatility imparts greater curvature to the term structure. By experimenting with different starting short-term interest rates, and assuming different volatilities, we can generate a rich set of possible term structure shapes and select the one that best fits the one given by actual zero coupon bond prices. To get better fits, economists sometimes include more parameters (e.g., nonconstant volatility, mean reversion of interest rates) and additional factors. But the point of this exercise is to produce a set of stochastic interest rate paths that is consistent with observable prices of highly liquid securities, and then apply the technology to obtain prices and behavior of other assets or liabilities.

When computing interest rate sensitivity measures such as duration and convexity, traditional formulas no longer are appropriate. Rather, the measures should be computed in a manner consistent with our valuation techniques. For example, duration should be computed by taking an interest rate process such as that shown in Chart 9, jiggling the starting interest rate (and therefore all subsequent interest rates) by a small amount, revaluing the cash flows, and taking the percentage difference in the implied values and dividing by the amount of the interest rate jiggle.

The preceding discussion and charts illustrate several verities that mark modern approaches to valuation (see "Implications"). My purpose herein was not to derive these verities in any rigorous fashion but rather to reveal them in an intuitive way and demonstrate their importance. An excellent, rigorous treatment and useful bibliography of this topic is given by Pedersen, Shiu, and Thorlacius (1990), op. cit. The bottom line in the modern approaches to valuation is that interest-sensitive cash flows should be discounted by the sequences of single-period interest rates that could give rise to them.

CHART 8

Discounting by Interest Rate Paths

Continuing in a similar pattern, we would compute the entire term structure, under this reduced volatility assumption, to be:

5-Year Spot Rate = 7.9260 %

4-Year Spot Rate = 7.9445 %

3-Year Spot Rate = 7.9630 %

2-Year Spot Rate = 7.9815 %

1-Year Spot Rate = 8.0000 %

Term Structures under Differing Volatilities

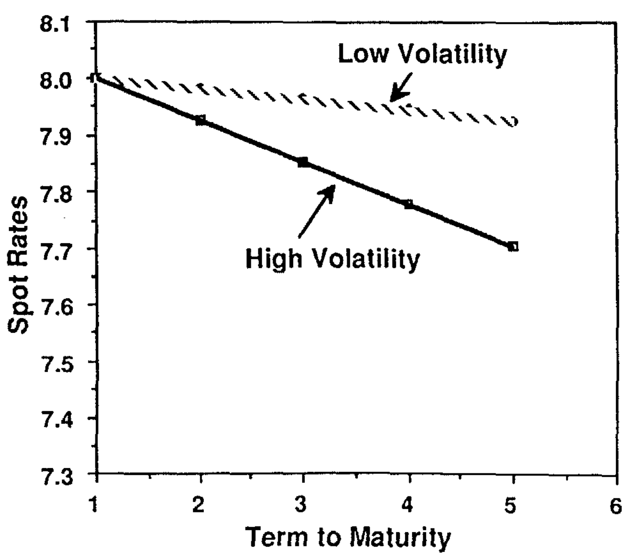


CHART 9

Interest Rate Binomial Tree

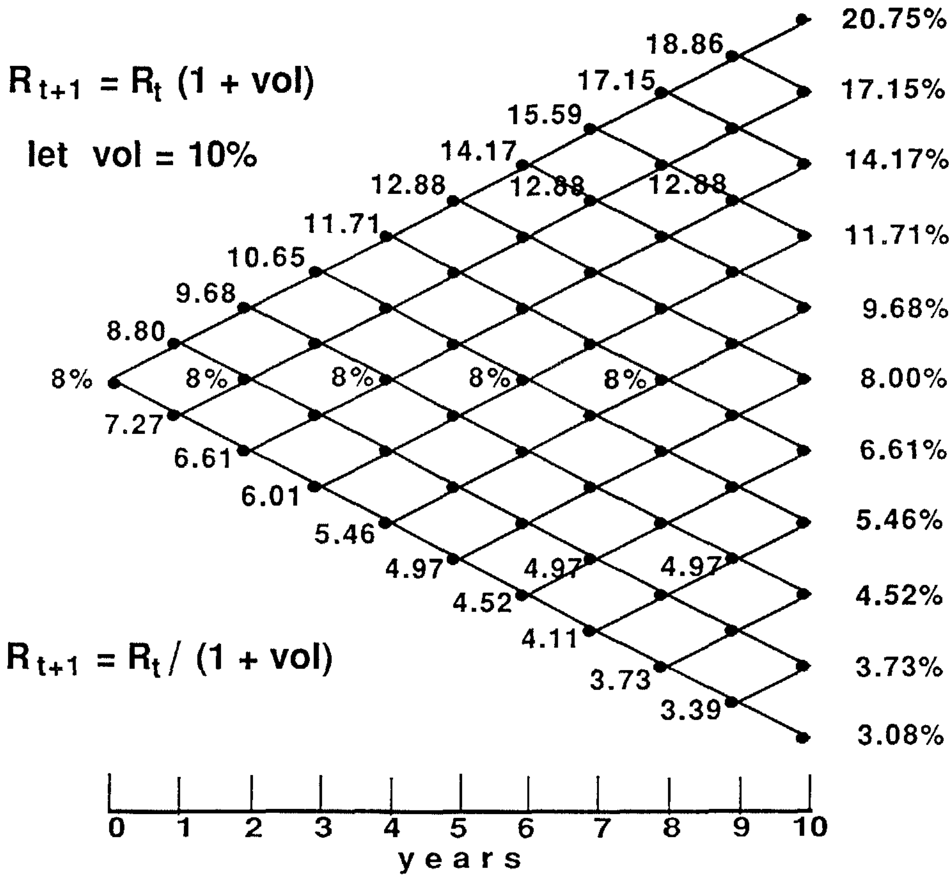
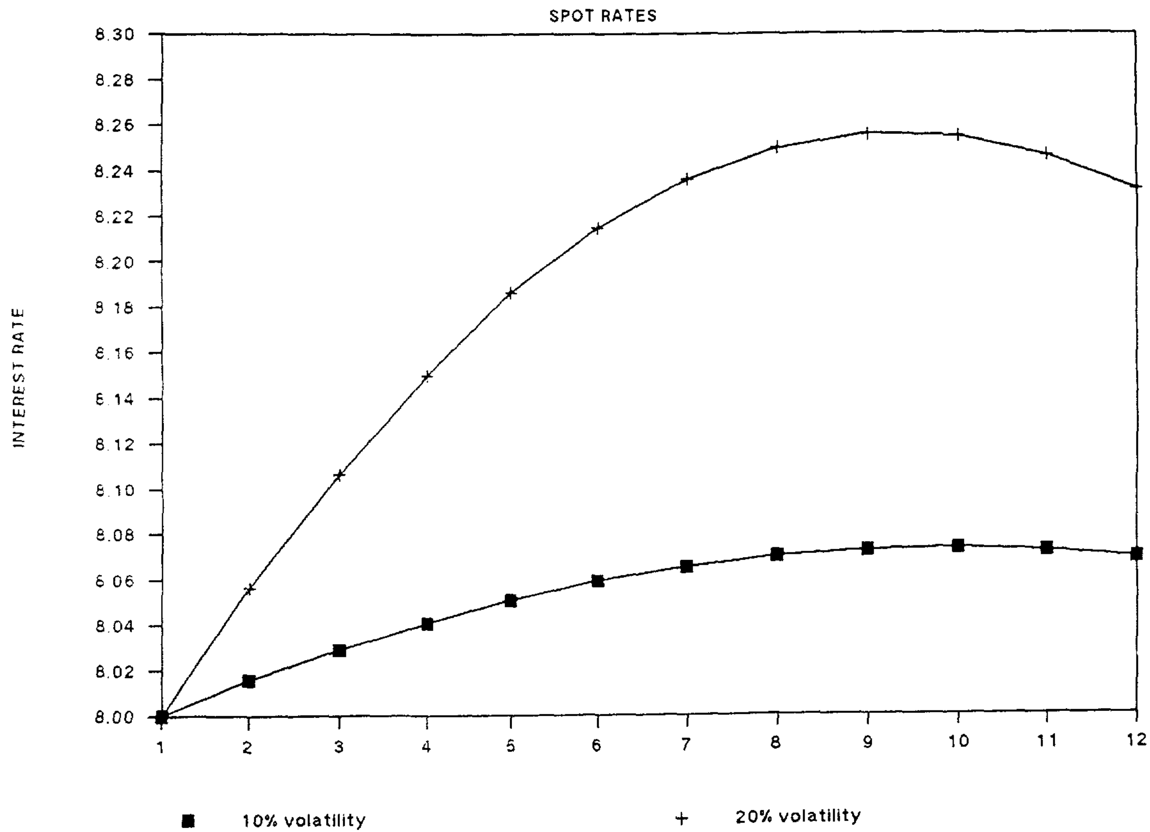


CHART 10

YIELD CURVES



The resulting present values then should be weighted according to the likelihood of a particular interest rate path materializing. This is true whether the size and/or timing of the flows is linked to short-term or long-term interest rates, volatility, or some other factor related to interest rates. Moreover, it doesn't hurt to apply these same approaches to the valuation of instruments, such as noncallable Treasury bonds, whose cash flows are independent of interest rates. Indeed, the prices implied by the models should be just as good as those achieved by discounting the cash flows with spot rates of interest. This feature often serves an important checkpoint in setting up models of stochastic interest rates and initializing their parameters.

IMPLICATIONS

1. If interest rates are not expected to remain stable over time, cash flows may be discounted by the paths that interest rates could follow, and these discounted values can be averaged to get fair market values.

2. If the size of cash flows is not influenced by the level of interest rates over time, one may also use the spot rate yield curve to discount the cash flows and arrive at fair market values.

3. If the size of cash flows is influenced by the level of interest rates over time, it is erroneous to discount cash flows by the term structure of interest. The higher the volatility, the more sizable the resulting calculation errors.

4. As interest rates become more volatile, the shape of the term structure will change, even if expected returns do not change from prior levels.

5. Techniques appropriate for discounting cash flows under volatile interest rates are as follows:
   - Binomial or multinomial interest rate trees, lattices
   - Simulations (single- or multi-factors)
   - Simulations through trees, lattices, etc.
   - Sparse grids

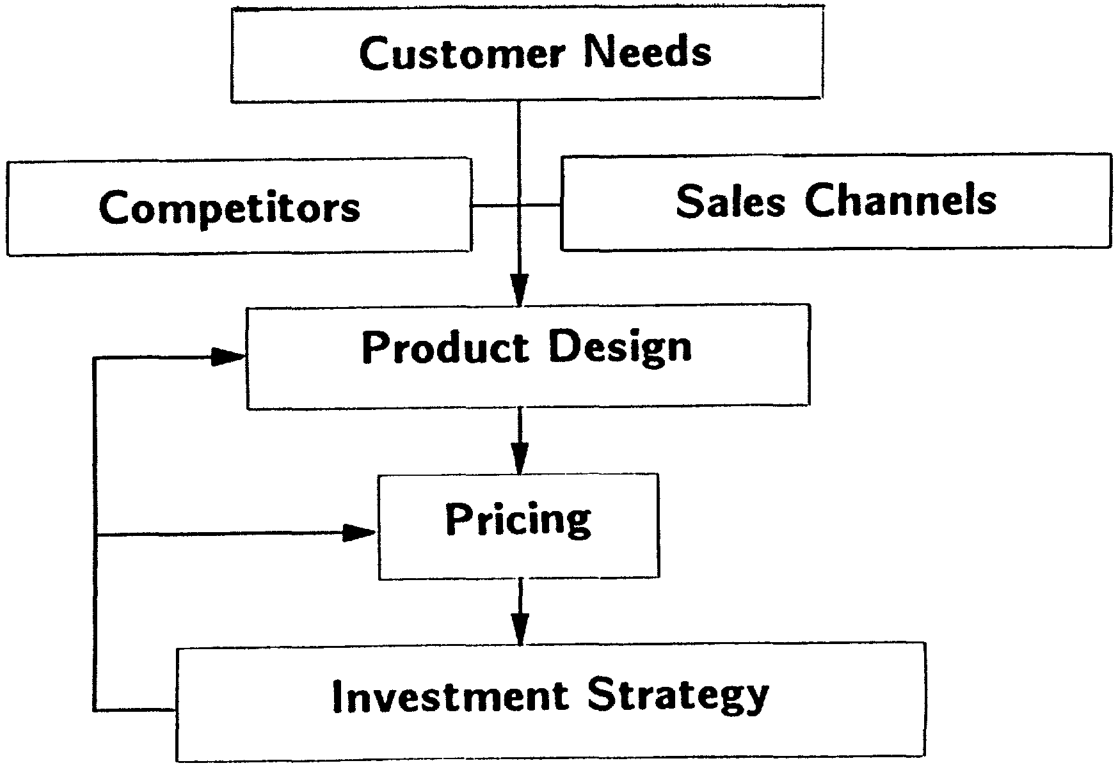
As indicated in point 5 above, several technologies have been developed to apply the pricing insights of State Preference Theory and Arbitrage Pricing to interest-sensitive cash flows. Each model has its advantages and limitations. Yet we may say with some confidence that the stochastic interest rate models that are now the norm on Wall Street for valuation have produced significant insights into the pricing and behavior of assets and liabilities with interest-sensitive components. It is not an overstatement to say that it would be foolish in today's competitive environment for a financial institution to issue interest-sensitive liabilities or invest in interest-sensitive assets without having gained the insights provided by these models.

MR. THOMAS A. MCAVITY, JR.: Without minimizing the importance of life contingencies and other noninvestment risks, I suggest that in our business we're investment intermediaries (Chart 11). We're packagers of investment returns. I think our two key objectives are to meet customer needs competitively, in order to be able to

CHART 11

PRODUCT FEATURES VERSUS INVESTMENT POLICY

Asset Liability Management



attract and retain deposits, and to create stable and profitable spreads that are immunized from excess exposure to interest rate and default risk. So how can we help our companies achieve these objectives?

Whether we offer fixed or variable products, the benefits we deliver to the customer have to be created from choices in the capital markets. We don't make them out of thin air. I think it follows that a key factor for success in becoming a good packager, and a risk manager, is to combine a clear vision of customer needs with a clear vision of what return patterns are available from the capital markets. I think of the concept of transparency between the two end users. Our customers are one set of end users and issuers of securities in the capital markets are another set of end users, and we want a transparent pipeline, whereby we pass through investment returns from one to another.

For example, this framework can be applied to the retirement needs of our customers. We think that in addition to being able to illustrate the build-up of a large lump sum 17 years from now, for example, the customer ought to be concerned with inflation. Just consider that the retiree wants to be able to maintain a certain lifestyle from age 60 or 65 on. The difference between inflation at 3%, and inflation at 8% compounded over (let's say) 17 years could have an enormous effect on the buying power of a lump sum of say, $200,000; that's the difference between a 30-foot cabin cruiser and a skiff. Maybe worse. So it isn't enough just to think in terms of credited rates on an annuity. I think you can apply a lot of good thinking that's gone on in the investment literature, about asset allocation methodology combining the build-up of capital with inflation protection. The equity certainly comes to mind. In addition, if inflation is a concern, a long-duration bond portfolio isn't very suitable, because you're forced into a certain compounding rate, except to the extent of reinvestable cash flows, and interest rates do tend, over a period of time, to follow inflation. If inflation rises from 4.5-9% and stays at 9%, interest rates are likely, based on historical experience, to rise to the 12% area. If we're locked into today's interest rates we're not going to be able to deliver a very good inflation protection. So it would suggest a shorter-duration bond strategy (Chart 12).

I think another key factor for success is to be able to integrate the product strategy with the investment strategy so that the risks assumed by the intermediary are minimized, customer needs are met as effectively as possible, and the benefits to the customer are priced realistically. Integration requires team work. If there are walled fortresses that separate the investment people from the marketing people, maybe these walled fortresses need to come down. And you know, you might note on the side here that a lot of our advanced corporate America style compensation schemes, the reality when we get back to the work of how our boss cares about the bottom line, are these bottom lines measured in such a way as to reinforce rational economic behavior? Or are they holdovers from days when the name of the game was to sell as much as possible, produce as many mortgage loans as possible? Are the measurement systems congruent with corporate economic goals? I think that's an important question for all of us. Maybe it's not our job to make those decisions but we can at least bring these issues to light.

Integration can be facilitated by using what I call a liability based benchmark. The concept here, the big box, you can think of as the packaging process: the packaging and

CHART 12

PRODUCT FEATURES VERSUS INVESTMENT POLICY

Customer Needs

Capital Accumulation

Inflation Hedge

Availability/Liquidity

Security

Capital Market Choices

Equities-Stocks, Real Estate

Fixed Income-Long

Fixed Income-Intermediate

Fixed Income-Short

Options-Long or Short

marketing, including the marketing tools, the product design, and how we're going to price the strategy. If we think about a single premium deferred annuity (SPDA) here, the pricing strategy would involve what kind of credited rate do we want to be able to offer in the future, recognizing that interest rates may go up or may go down. We may have a steeply sloped yield curve or an inverted yield curve. Under various circumstances, what kind of performance do we need to maintain for our customers to give them good benefits and to make sure that we don't have excess lapses that would cause disintermediation risk? The idea of the liability-based benchmark is to try and identify, using a fairly simple menu of assets -- perhaps just Treasuries and options -- what kind of investment strategy would support the desired pricing strategy. By simplifying it to a limited menu of assets, it makes the job more tractable and helps focus on the embedded options, and if you embed options in the liabilities, then maybe you need to buy them back in the capital markets. Once a liability-based benchmark is defined, then the investment department can use that as a guideline and manage around it, possibly earning incremental returns by taking a number of small risks, none of which involve betting the ranch, and most of which may be statistically independent (Chart 13).

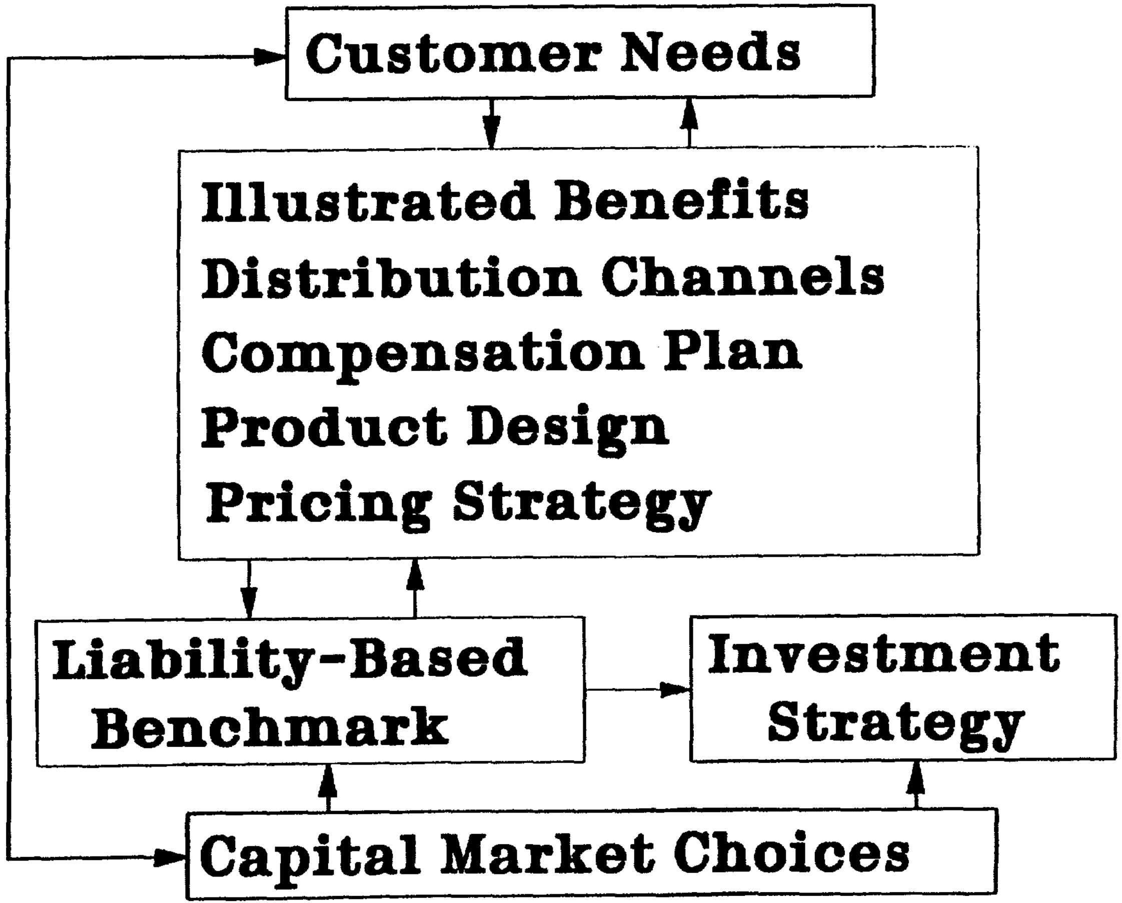
Chart 14 illustrates what you might think of as an iterative process. Starting at the top, we might be looking at a particular strategy, involving pricing and an investment strategy. We take a look at all the risks we're assuming. The degree of mismatch might be really bad if interest rates rise 200 basis points. Recognizing those risks, a certain amount of economic capital is required which would include the total of C-1, C-2, C-3, and C-4, measured in an appropriate economic fashion. That would lead to a spread requirement, or profit target, and might, if we're short, need to stretch for additional return in the asset portfolio or re-engineer the product design. Now let's look at it more positively. Let's say that we find a way to reduce the risk, by perhaps buying put options or caps. That might shrink the economic capital, which would shrink the spread required, hopefully paying for the puts and maybe having a little change. That little change might enable us to take less default risk. We're basically working ourselves down to a really wholesome, stable spread management situation.

Notice the statutory and accounting constraints over on the left. I don't mean to get off on the commissioners annuity reserve valuation methods (CARVM), but the way I think is healthy to look at this is that we need to respect the statutory rules of the game, the nonforfeiture rule for example, all the customer protection requirements, because we have to comply. We also have to respect our CEO's desire to maintain stairstep increases in earnings per share. Subject to those constraints -- if any of you ever studied linear programming, you think of those like constraints in the tableau -- what do we really want to maximize? What's the real economic health of the company tied up in? I think it's the economics and over time the accounting results will follow the economics.

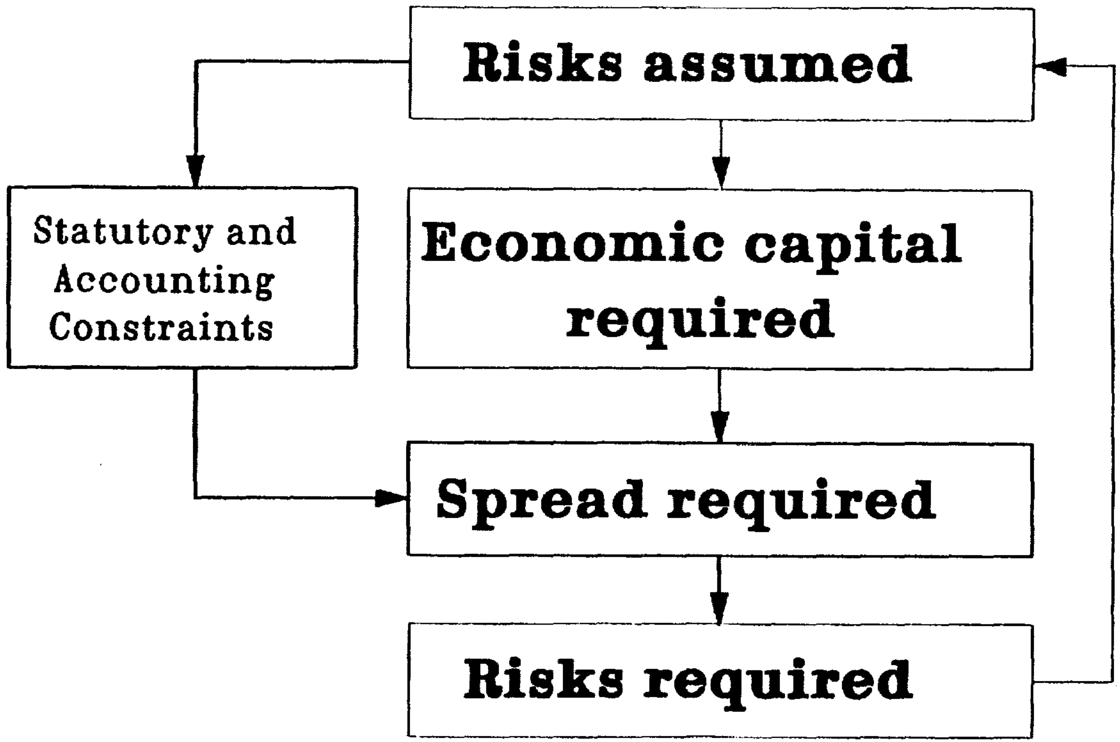
As a result, I'm suggesting here an economic focus based on total return and market values. Immunizing insurance products with bond portfolios becomes more difficult and expensive when these products contain embedded options. I've catalogued some of the options embedded in insurance products (Chart 15). In addition to the lapse option, or surrender option, I want to touch on that fourth one, the competitor new money rate. This is a kind of subtle, complex option that makes the lapse option more valuable.

CHART 13

PRODUCT FEATURES VERSUS INVESTMENT POLICY



STRATEGY DEVELOPMENT PROCESS



PANEL DISCUSSION
CHART 14

CHART 15

Options Embedded in Insurance Products

	SPDA	FPA	U/L	B/R GIC
Funding/persistence		X	X	X
Lapse/withdrawal	X	X	X	X
Adverse selection for mortality risk			X	
Competitors' new money rate linked to higher of: - Market yields (rates rising) - Portfolio book yields (rates falling) Carrier sets own new money and renewal rate				

What this says is that if I'm a customer and Lincoln is giving me 9% right now, the competitors are going to be out there offering the best rate they can. If rates had been dropping, someone with a portfolio rate that dates back to 1983 or something, when the rates were higher, is still going to be offering an above-market rate, using their portfolio rate to subsidize new business. If rates are rising, however, the competitor is going to be using the highest rate now available, and building a new product around it, trying to lure away my customer -- and, of course, my agent will be delighted to help them. So, the rate that we're crediting on our renewals has to be competitive with the higher of what would stem from a rolling portfolio in a declining rate environment, or prevailing yields at the shorter long end of the curve, in a rising rate environment. The challenge is to find an investment strategy that supports reasonably competitive credited rates in all interest rate environments. The good news on these embedded options, the funding and lapse and adverse selection, is that they're not exercised efficiently. I mean I'm too busy to do a rollover, or you're not aware of it, or the agent doesn't call you and we're just not that efficient. I think the efficiency of exercise is going to vary a lot demographically, by channel and probably a lot of other factors.

I think that the traditional use of static pricing models in our industry has led to a knee-jerk reaction to try and maximize book yields, nominal yields. We see 30-year utility bonds, callable in five years. The option cost in these bonds is very, very, heavy. It's unrealistic to price off of nominal yields with callable securities, and it's also unrealistic to not really look at the default loss distributions. It's rare that you actually collect the full amount in the nominal yield on a corporate bond portfolio over a long period of time.

Interestingly here, we have the opportunity to buy some products with long options embedded in them. We don't always give away options, and put bonds incorporate the option for us as investors to put the bond back to the issuer if rates have moved up. We want to take our money out of a 9% bond and put it in an 11% bond. This is a beautiful match with the kind of performance we'd be looking for to match up to an SPDA or UL portfolio. Convertible bonds offer an interesting play on the rise in equity values, while maintaining a somewhat lackluster current yield. Adjustable rate preferreds have that interesting character of the competitive rate. They reprice periodically based on the higher of the short-, intermediate- and long-term rate. It includes that higher error of effect. Unfortunately, the supply and the availability of the diversified set of names are very limited in that sector of the market.

Chart 16 shows total returns analyzed over a one-year horizon assuming parallel shifts in the yield curve and illustrates the classic short straddle perspective on our industry. Short straddle refers to an options strategy where, for some reason, you feel confident that the market isn't going to move up or down very much. So you write call options and put options and hope, cross your fingers, that the market isn't going to move. It seems like a very risky strategy and it is. That's exactly what many of us do in the ordinary course of business. The callable curve reflects a typical insurance company strategy, where yield has become the driving force. Callable bonds do have a higher nominal yield -- probably not higher expected returns. The graph is based on a put bond, but it's roughly similar to the kind of return necessary to support an SPDA. If you think of the puttable bond as being the liability portfolio and the callable as being the asset portfolio, what happens to surplus, which would be the spread between? You can see that using this as a model, if rates don't move we're in pretty decent shape, but if rates do move, we're hurting.

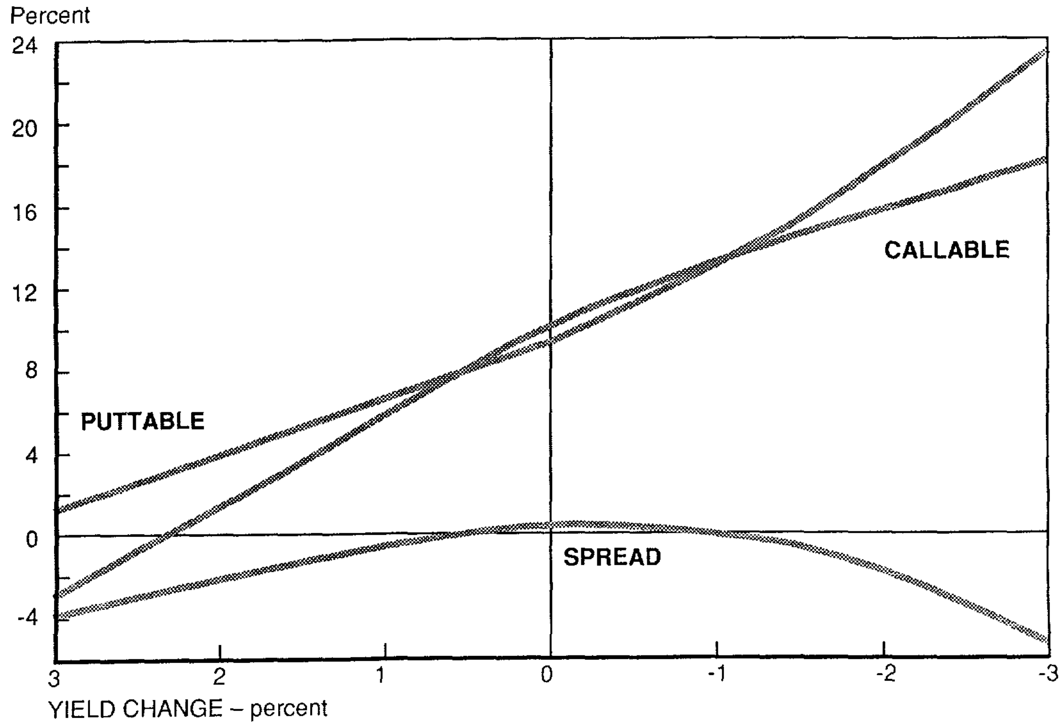
The riskiness of that kind of surplus exposure can be reduced by buying back embedded options. This can be engineered using a fairly simple portfolio to simplify the computation. Because really it's the generic performance profile, not the specific assets, that matter. I'm not going to dwell on these individually, but I will mention the mortgage-backed security derivatives include things like PO, Strip, Super POs, and inverse floaters. Mr. Babbel mentioned caps and floors which are very suitable for buying back the kind of options we embed. They do tend to trigger off the short end of the yield curve, so if you're concerned about intermediate- or long-term rates rising, they're not a perfect hedge. Maybe some combination of caps and floors and options on swaps, what we call swaptions, which would trigger off a longer dated underlying rate, would be a more balanced kind of hedge along with put bonds.

To capture the effects of interest sensitive cash flows and their economic and financial consequences, we need to simulate the evolution of interest rates. We use simulation because a lot of the cash flows are path dependent. To model a cash flow at a given time, we need to know what's happened up until that time both to rates and to cash flows. Simulation can be very useful, not only in a full-blown Monte Carlo approach, but also deterministically, looking at a smaller, more modest set of scenarios and also, the application of optimization becomes tractable (Chart 17). You can actually optimize an initial portfolio of bonds and options. I'd be very cautious about optimization, however. I think the real goal is insights as to what kind of combination of bonds and options best immunizes dynamically. Mr. Babbel covered the idea of option pricing. One of the key outputs here is option-adjusted spread which is, we think, a better way to look at the expected cost of the liability.

Now, more specifically, the key steps in doing an option pricing valuation of the liability, which would be consistent with how bonds are valued, therefore allowing you to consistently look at asset and liability and the key, the difference, the economic value of

CHART 16

ANNUAL RETURNS
One Year Horizon



surplus, which I think is what it's all about, is starting off with a realistic interest rate process that is arbitrage free, with suitable volatility assumptions.

CHART 17

Uses of Simulation

	Monte Carlo	Deterministic Paths
- Stress Test		X
- Optimization		X
- Option Adjusted Spread	X	
- Price Product Features	X	
- Test Pricing and Investment Strategies	X	X

Then compute cash flows working forward in time, remembering the history of rates and cash flows, discounting along each path using the interest rates along each path, probability weighting and then computing the option-adjusted spread, and the sensitivity analysis to shocks in the interest rate process. There is some new technology that looks different, looks explicitly at shifts in the process and twists and bends, and empirical research has shown that these three kinds of movements explain virtually all of the historical movement in interest rates. The technology here is moving very, very rapidly. You can learn a lot from the Wall Street firms, and from independent consulting firms, such as Barra or GAT. Your investment people are probably soaking this up, even as we speak. I strongly encourage a team relationship between the actuaries in a company and the investment people, the portfolio managers, and quantitative people.

In the simulation the interest rate scenarios are laid out first (Chart 18).

CHART 18

Simulation

	Event/Result	Choice
Interest rate scenarios	X	
Competitive new money rate	X	
Set renewal rate		X
Set new money rate		X
Investment strategy		X
Persistence	X	
Lapse	X	

The competitive new money rate is modeled and then we simulate what our company is going to do with a renewal rate, the new money rate, what adaptation is going to be made in the investment strategy, and then using the model based on assumptions, we'll predict at each point in time the performance of the customer with regard to persistence and lapse behavior.

I want to show you an example of how we might model the competitive rate using the concept I mentioned before. Chart 19 includes the prevailing one-year and 10-year yields and the book yields that would be the case based on a rolling portfolio of buying seven-year Treasuries. The model reflects the higher of the three rates with certain spreads added or subtracted.

Just to build a little credibility here, I took that model and compared it here with the rolling seven (Chart 20). That's what we would want to credit if we were a portfolio rate company and wanted to maintain our margins and use the seven-year investment strategy. The one that sticks way up in about 1981 to that 14% is the rate predicted by the model. That's what new money rates would have been predicted to be. The one in between with the stairstep pattern is what we actually credited on our policy during that time. It shows that we really took a bath in the early 1980s trying to balance between "Should we try and preserve our margins and hope our customers don't notice that we're 8 points below the market? Or should we try to remain reasonably competitive and put profit off for a future date?"

We'll look briefly at how we might use an arctangent form of modeling lapse rates (Chart 21). It seems to have the right shape, where you see kind of an elbow in the curve, at around between 1 and 2% disadvantage. That axis is a measure of how our rate compares with the competitive rate. If we're 3% below the competition, the line which assumes zero surrender charge would suggest a 50% per year lapse rate. I don't claim this is accurate. I mean it's just the shape I'm suggesting that is a good starting point. It's up to you to use historical data or judgment or a combination thereof to calibrate this thing.

From the mortgage backed securities business, we've learned about something called burnout. What this refers to is that a population of mortgage holders might tend to pay off. Let's say that a bunch of people have a 12% mortgage and rates now have dropped to 10%, and a fair number of them are going to repay their mortgages and they figure it's going to cost a point to get refinanced, but they can pay that back in six months and have a two-point advantage thereafter. They'll go ahead and refinance. Those people in the population who are keenly aware of rate will tend to refinance. But the theory is that the remaining people maybe aren't as keenly aware, they don't care, they're never sure enough that they're going to have a job that long. Maybe they don't have a job. Maybe they're not plugged into the mothership. In any event, the idea here is that the hotter money boils off first, the cooler money is left behind so the propensity to prepay actually drops over time. As people have the opportunity to prepay, those that do, do, and those that don't, probably won't in the future (Chart 22).

Table 1 is an example of the results that can be obtained by simulating an SPDA. The required spread refers to the spread over riskless treasuries that would be required to

CHART 19

COMPETITIVE RATE MODEL VS. ROLLING 7-YEAR AND MARKET RATES

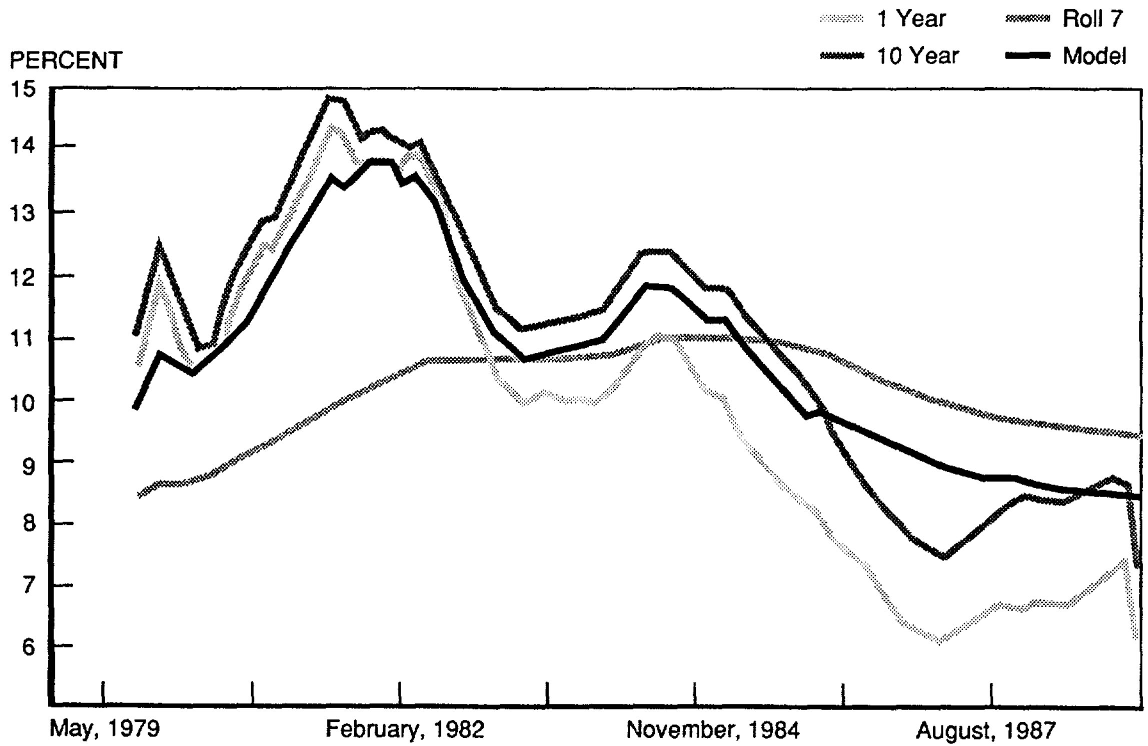
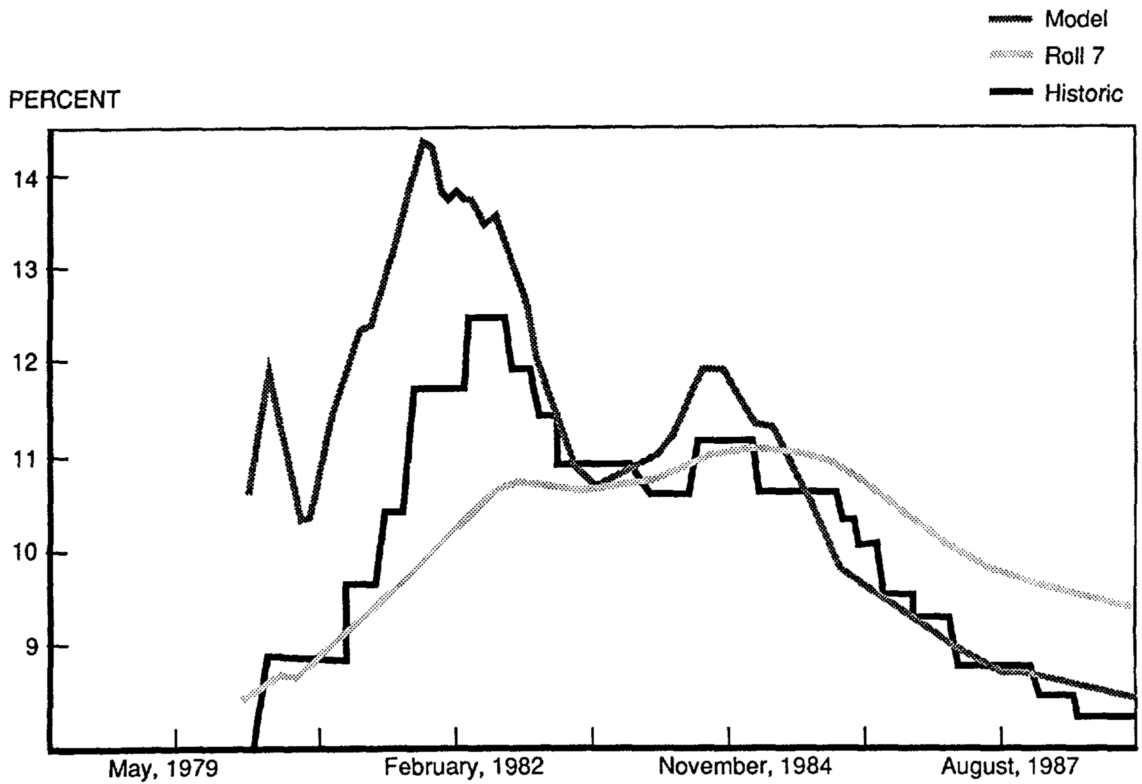


CHART 20

COMPETITIVE RATE MODEL VS. ROLLING 7-YEAR AND HISTORIC



LAPSE RATES

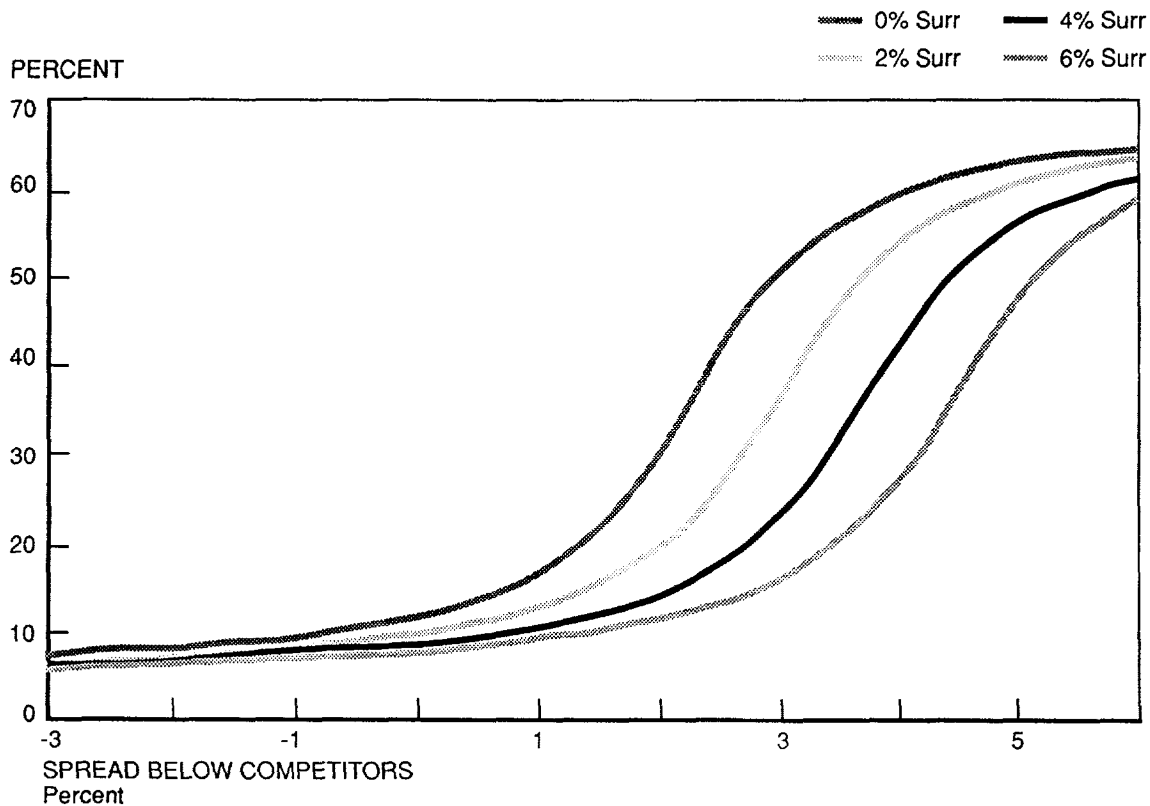
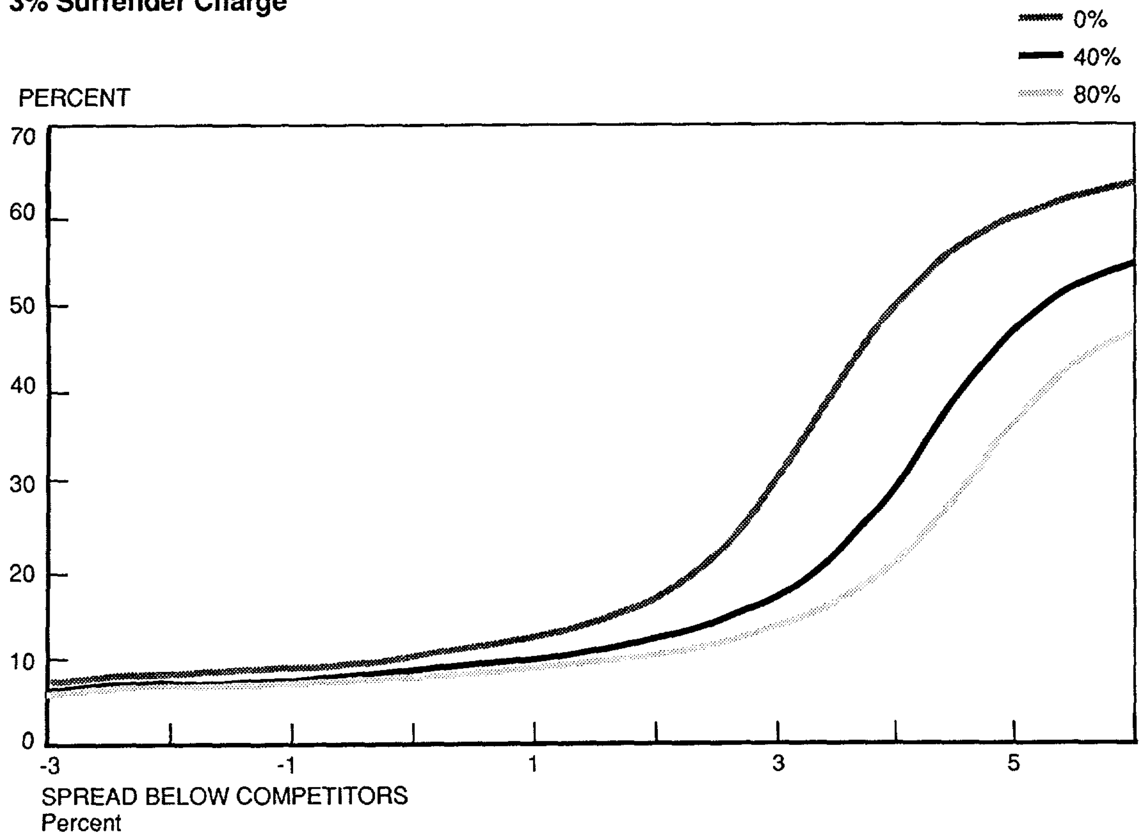

0% Surr
4% Surr
2% Surr
6% Surr
PERCENT
70
60
50
40
30
20
10
0
-3
-1
1
3
5
SPREAD BELOW COMPETITORS
Percent

CHART 22

SEASONING OF LAPSE RATES
3% Surrender Charge



cover exactly the cash flows, including the recoupment of the acquisition costs and any teaser in the operating expenses and the credited rate incorporated in the monies paid out to the policyholder. It includes nothing for profit or for risk, and the return on surplus is just a judgmental amount added on based on our assessment of risk in this particular policy. With investment expenses we were looking at a 170 basis point requirement, risk adjusted, from our asset portfolio, which is incredibly high. The right-hand column showed the effect of holding everything else constant, including the choice of paths and saying, "What if we had an assumed minimum guarantee of some level and we dropped it 1%?" You know, 6 to 5 or 7 to 6. It reduced the cost of liability by 8 basis points. Down at the bottom, note that it decreased the duration from 2.9-2.6 and decreased the convexity which is a measure of the option content. It's sort of the measure of how important the embedded options are. Both the 72 and the 45 are very high. I believe zero coupon bond convexity is typically the square of its duration. A normal zero coupon might have a convexity of about 7, so 45 is very convex. It requires buying options to eliminate the risk.

TABLE 1

Simulation Results

	Originally	Reduce Guarantee
Required spread		
Liability cash flows	85	77
Return on surplus	70	70
Investment expenses	15	15
Subtotal	170	162
Risk characteristics		
Option adjusted duration	2.9	2.6
Option adjusted convexity	72	45

In summary, looking at interest-sensitive products, we try to identify and value the embedded options and fiddle with the product such that it becomes more transparent. If we need to offer embedded options, maybe we offer the product with and without the embedded options and price the options based on the cost of offsetting them. Offer the customer the choice of a no-frills product or, equivalently, a market value adjusted product, and let the customer decide where his preference is.

I believe that by buying back embedded options, we can reduce risk, reduce profit requirements, and offer a more competitive product with less risk to our company.

MR. JAMES F. REISKYTL: My part of this program is a significant departure in many ways from our two previous speakers. They sought the best investment and pricing strategies to maximize company profitability recognizing that a significant number of policyowners will fail to act in their self-interest when better values become available -- and others are slow to respond.

My presentation focuses on providing maximum value to all policyowners while generating sufficient profit to continue as a healthy, viable company.

PRODUCT FEATURES VERSUS INVESTMENT POLICY

These are quite different philosophies, so switch over to maximizing policyowners' values -- not profits -- for the rest of this session.

Let's begin with a quick poll. How many of you work for insurance companies? How many of your companies use total return from equities to support your insurance products?

Just to be sure we all have a common understanding and are responding to the same question -- let me clarify that I define equities to include common stock, real estate, oil and gas and other energy investments, shopping centers, subsidiaries and affiliates and similar investments -- and I am not asking about variable products since by definition they all do.

How many of you are consultants? How many of you have done work for companies using total return from equities to support their insurance products?

Until five or six years ago, of course, the investment strategy of most companies was to offset capital gains with losses to offset the tax and improve the overall yield. Perhaps some still have this strategy.

But things have changed -- with lower new investment rates and strong stock market there are few if any capital losses available for many companies; the tax law no longer differentiates between investment income and capital gains; and some companies, including mine (NML), have significantly changed their investment mix to include a substantial share of equities. To complete this brief poll, how many of you work for companies with a significant share of equities in the investment portfolio supporting their insurance products?

I presume your answers reflect in large part the products you offer since clearly equities are not appropriate for all lines. NML's major line is traditional participating life plans -- most with fixed premiums so equities can be used to enhance long-term returns. On the other hand, we have no equities in our annuity segment -- a major line for many of you. Disability insurance (DI), UL credit, health -- are not very likely to have supporting funds invested in equities.

For the remainder of my presentation, I am going to focus on participating whole life and the various issues that arise from greater investment in equities. Perhaps after I am done others may wish to share their responses to these issues for other products.

Obviously increased equity investments mean lower current investment income, a dependence on future capital gains, and greater volatility of results. As a result, we needed an appropriate measure of investment performance to use for pricing and dividends, primarily the latter.

We sought a measure that had four characteristics. (1) It should be relatively stable from year to year. We sought this because we wanted to use the rate as a guide to settling our dividend interest rate -- which is a portfolio rate. Our policyowners expect this rate to be fairly stable. (2) The measure should take capital gains/losses into account. (3) The measure should be accurate -- that is, it shouldn't be biased up or down from actual results. (4) The measure should reflect current experience and future expectations -- not just historical results.

The resulting rate could be used for pricing as it provides a better measure of profits, or as we use it, as a guideline for setting our dividend interest rate to increase intergenerational equity. If dividends were only based on current cash investment income -- increased equity investments would mean current policyowners would receive lower dividends now and higher dividends later if and when the capital gains are realized -- an unacceptable result!

We considered various choices for this measure: annual statement, internal rate of return (IRR), or total yield.

The annual statement rate, even with policy loans removed, won't do since it excludes capital gains and even if they were included, the resulting rates would fluctuate widely.

The IRR used by the investment department for their comparisons also fluctuates widely with changes in the economy. A moving average of these returns falls short too -- since it is based only on historical results.

So we developed our own measure -- the equity adjusted or total yield.

The total yield consists of the book income rate on fixed income investments and the total expected return on equities -- where the latter is defined to be income plus capital gains. This rate is fairly stable since it spreads expected capital gains over the life of the equity investments. This measure also reflects both actual results and future expected return, as will be discussed in greater detail shortly.

Total yield must be adjusted for both fixed income and equity capital gains and losses.

The company must decide how to spread these gains (straight line, sum of digits, etc.) and over what period of years (exact or approximate).

NML spreads the capital gains or losses on its fixed income investments over the average original life of the investments. In effect, it treats them like they had never occurred since the substantive economic effect is usually only federal income taxes.

For equities, the gains can be spread by type of investment -- e.g., common stock, real estate, etc. -- or by each investment using either individual analysis or some kind of averaging.

The basis for projecting the total yield on equities can vary from individual assessments -- both originally and periodically thereafter based on actual results to date plus future expectations -- to assessments based on simple approximations such as the fixed AA bond rate plus X basis points where X reflects historical performance or current expectations or some combination. For example, one may estimate common stock total return as a fixed AA rate 350 basis points, if that reflects your best estimate of actual results and likely future performance.

Currently we use individual assessments for most investments other than common stock where we use a formula. We update these estimates at least once a year. For example, NML bases its total expected annual return on real estate on projected cash flows over the next few years plus the projected market value at the end of that period.

The total yield calculation has some special definitions reflecting differences in market values and annual statement values.

For total yield calculations, equities are valued at market and fixed income investments are valued at amortized costs, with amortization of fixed income realized capital gains or losses -- as described earlier. Thus, market value of assets is uniquely defined. More specifically, capital gains are defined as recognized and unrecognized -- based on annual statement definitions. Hence, recognized gains are all realized gains plus unrealized gains on common stock, foreign currency, and other asset revaluations. All other gains are unrecognized gains. Finally, total equity adjusted gains include recognized gains plus the change in unrecognized gains for that year. All calculations are pre-tax. Tax charges must reflect current income and capital gains and losses as well as future expected gains which is further complicated by the extra mutual only tax.

Our intent is to pay a dividend interest rate that is greater than the all fixed income rate but less than the total yield rate.

We keep track of both realized and unrealized gains using two scorecards -- one on a market basis and the other on a book basis (Table 2). Both are cumulative and both measure only equity investment gains or losses. Our scorecard is used for the total yield rate -- and includes realized and unrealized gains/losses on all equities. The other scorecard is used to measure annual statement results. Here's a sample -- the market scorecard shows total expected gains to date based on total expected yield for all years since this method was adopted to be $1 billion -- the actual gains achieve to date are $1.1 billion -- so this company is currently $100 million ahead.

TABLE 2

Sample Scorecard

	Market	Book
Expected gains	$ 1,000	$ 650
Actual gains	1,100	800
Difference	$ 100	$ 150

The annual statement scorecard in this example shows total expected gains to date to be $650 million calculated each year as the total yield less the NAIC rate on nonloaned assets times the book value of nonloaned assets. The total gains actually needed each year are greater. The difference reflects unrealized gains on equities that aren't marked to market in the annual statement (such as real estate). On a book basis the scorecard shows an excess of $150 million. Any market value differences (+ or -) could be amortized into the total yield over a period of years. We also keep track of realized and unrealized gains to date to measure results achieved and realized, as well as future potential. To summarize, for us, the total yield or equity adjusted yield is the best measure to use for guidance in setting the dividend scale interest rates since we invest in a significant amount of equities.

Each year we set capital gains targets for the company -- we actually set targets over a five-year period as we take profits when they make economic sense. Obviously, we will have some good years and some lean years but must, on average, harvest the targeted capital gains annually.

Each equity is reviewed at least once a year and the total yield rate is calculated quarterly. Scorecards keep senior management and the investment departments informed as to our progress to date and provide appropriate adjustments.