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Derivatives in Insurance Products

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Summary: The role of derivative instruments in insurance products continues to increase in importance. Most fixed-interest products contain guaranteed interest rates that are equivalent to interest rate call options. Other products such as equity-indexed life and annuities and variable annuities with guaranteed benefits contain embedded derivatives. Many actuaries have little experience in identifying and pricing derivatives. This session analyzes derivatives contained in various insurance products and techniques used to hedge the derivative exposure.

MR. MICHAEL J. HAMBRO: There are many examples of equity derivative features in insurance products. There are equity-indexed annuities and life insurance. There are guarantees on variable annuities and Canadian segregated funds, such as guaranteed minimum accumulation benefits (GMABs), guaranteed minimum income benefits (GMIBs), guaranteed minimum withdrawal benefits, and a guaranteed payout annuity floor. Another example is institutional products such as total return group annuities. There are many more, but this is just to highlight a few examples.

The focus of this presentation is going to be on equity-indexed annuities and on guaranteed minimum accumulation benefits. Some of the material I'm going to discuss is greatly simplified in order to highlight the derivative features of these products.

Note: The chart(s) referred to in the text can be found at the end of the manuscript.

I'm going to start with equity-indexed annuities. This product is a deferred annuity that provides a return of principal guarantee, plus participation in the growth of one or more equity indices, usually subject to some sort of minimum guaranteed growth rate. There are several indexes that are available for the product, such as Nasdaq 100, Russell 2000, Dow Jones Industrial Average, and international indices, but the Standard & Poor's (S&P) 500 still predominates.

For our simplified product we're going to assume that the customer pays a $100,000 single premium at issue. At the end of five years he's going to get his premium back, multiplied by one plus the percentage increase in the S&P 500. In no event will he get less than the premium back. We're going to assume no withdrawals or other terminations are permitted. The issuing company has no expenses, taxes, or required profit margins. We're also going to ignore some of the intermediate nonforfeiture guarantees, so I've stripped it down quite a bit.

The payoff structure from this product can be expressed as: 100,000 x MAX $\{1, 1+(S\&P_5\text{-}S\&P_0)/\ S\&P_0\}$ = 100,000 + $[100{,}000/\ S\&P_0]$ x Max $\{0, S\&P_5\text{-}S\&P_0\}$. What this payoff is equal to at issue is, first, the discounted value of the $100,000 return on premium guarantee, then units equal to $100,000 divided by the initial index of a five year at the money European call option on the S&P 500 index. Units equal to $100,000 over the initial index mean that the option has a notional amount of $100,000.

The company will have exactly enough funds to provide for the policyholder payoff if it purchases a five year zero-coupon bond that matures for $100,000, plus units equal to $100,000 divided by the initial S&P index of a five-year European at the money call option on the S&P 500 index. One of the major considerations is how much the option costs. So we're going to value the options. From a capital market perspective, in order to value the option, we've got to calculate the discounted expected value of the option payoff, assuming that risk-neutral conditions hold. Risk neutral means that investors have no risk preferences and that the expected return on all securities is the risk-free interest rate.

Why is risk neutral used? There are a couple chief reasons. We could use risk-averse assumptions and then we would use, for growth rates, the actual expected growth rate for the underlying securities of the index, but then the option payouts would have to be discounted at rates reflecting risk aversion. As it turns out, these two changes exactly offset. But more importantly, risk valuation is very convenient for the various option pricing formulas that are in use, and although these option-pricing formulas assume risk-neutral conditions, the solutions are still valid in the real world.

In order to value the option, we need several inputs. We need to know what the current index level is, the exercise strike price, how long the option is for, and the risk-free interest rate. We need to have an index dividend assumption because the option holder does not receive dividends from the securities underlying the index.

When dividends are paid, they reduce the value of the securities, and hence, the dividends reduce the value of the option. We also have an important assumption of volatility. This is not the historical volatility that you could calculate from recent market movements; it's implied volatility that is observed in today's market prices and it may actually be a consensus of how investors view volatility in the future.

In addition to these economic assumptions, we have to have a process by which the security moves forward into the future. It's very common in option valuation to assume that the market moves in a lognormal manner. We're going to make that assumption for this example. There are various option pricing methods, such as Black-Scholes and related formulae, binomial lattices or trees, Monte-Carlo simulation, and Esscher transforms, but regardless of the structure of the method in each case the valuation is accomplished by calculating the expected value of the option payoff assuming a risk-neutral environment.

For our example, the current S&P 500 index is 1,100; the exercise or strike price is 1,100; the time to option expiry is 5 years; the risk-free interest rate is 5.5 percent continuous; the index dividends are at 90 percent, continuous; and volatility is 25 percent.

In terms of the value of this option, I calculated this using a Black-Scholes option pricing formula and the European call option is worth $332.55 per index unit. Now, the desired number of units as we said before was 100,000, divided by initial index value, or 90.91 units based on a starting S&P 500 value of 1,100. This is equivalent to a notional amount of $100,000. So the price of the option is $30,232 or 30.23 percent of the premium.

Now we will examine the total value of the contract. The company has to return the $100,000 premium, plus the payoff from the option. Assuming a 5.5 percent continuous investment environment, the $100,000 zero-coupon bond will require an investment of $75,957. The cost of the option is $30,232, so the whole package is $106,189. The company only took in a $100,000 premium, so it really can't afford to provide a package that is valued at $106,189. Companies establish a participation rate. First the company reduces the option budget to what it can afford to pay, and in this case it will reduce it by 6,189. It produces an option budget of $24,043. Because the cost of the option per unit hasn't changed, it's still $332.55. The company had to lower the number of units it purchased from 90 and change to 72 and change. This is going to produce a notional amount of $79,530. The ratio 79,530 divided by 100,000 or 79.53 percent is called a participation rate and you'll see participation rates in any equity indexed annuity that's sold in the market. So in summary, the company can afford to return principal plus pay 79.53 percent of a five-year increase in the S&P 500 index and break even at the end under the rather loose conditions that we specified at the beginning.

Now, in addition to the European design, also called point-to-point design, there are other option designs in equity-indexed products. The Asian, or averaging, option's payoff is determined by some average of the index during the option's lifetime. A high-water-mark option's payoff is determined by some maximum security or index value achieved during the lifetime of the option.

Looking at the Asian option design, we're going to assume the same product and assumptions as in European design, but in this case the option payoff is going to be determined by the average of the index values that occur on each of the five policy anniversaries. Mathematically the payoff structure from the product is 100,000 + PR x 100,000 x Max (0, [$S\&P_{Avg}/S\&P_0$]-1), where PR is the participation rate. Again you have the first term as the principal guarantee, and the second term is the participation and the increase in the index or the function of the increase in the index during the lifetime of the option.

Now, as it turns out, an Asian option is worth much less than a European option per unit of the index, and the option budget from before was $24,043. That hasn't changed from the previous example. With this budget, the participation rate will be 127.6 percent. So the payoff from the product is 100,000 + 127.6 percent x 100,000 x (Max (0, [$S\&P_{Avg}/S\&P_0$]-1).

Now we can look at the high water mark option. In this case we're going to assume product C is identical to products A and B. However, it provides equity participation based on the highest anniversary index value during the 5 years that the option is in place. The high water mark option is more expensive than the European option and, of course, the Asian option per unit of the index. I calculated the participation rate for this product to be 58.7 percent. So, the European option was 79.53 percent, the Asian was 127.6 percent, and this high water mark is 58.7 percent. The payoff from the option follows the formula 100,000 + 58.7 percent x 100,000 x Max (0, [$S\&P_{High}/S\&P_0$]-1).

Chart 1 compares the payoffs for the three designs under three different scenarios. Scenario one is a rather nice market where the index goes up each year and performs better than what's happening now. Index scenario two is a market that drops rather precipitously during the first and second year followed by a recovery. Scenario three is the market that stays flat for a year, and then has a peak in year three, and a drop back in years four and five. Under scenario one, the European product performs best followed by the Asian product, and then the high water mark product. In scenario two none of the products do as well as in scenario one. The European still does best. The Asian product really gets hammered. In fact, it pays just about the principal guarantee. The high water mark comes in second. In scenario three, the European product performs worst, because the market only moved from 1,100 to 1,200 by the end, and the Asian and high water mark product performed about the same as each other and they outperformed the European product in this case. These product payoffs are all participation rate adjusted.
The market for equity-indexed annuity products is expected to be about $6 billion this year. Companies that have these products, from an investment perspective, really manage the products in two components. The fixed-income component is

used to provide for the principal guarantee and that's usually managed by either duration or key-rate duration. The derivative portion of the product is managed separately. There are several different ways that companies can attempt to hedge for their derivative exposure. One is to purchase exact matching options and there are really two ways to do this -- exchange-traded options or over-the-counter options. Exchange-traded options like Chicago Board of Exchange (CBOE) options offer good execution. In other words, there's not that much bid ask difference. They have good liquidity, but you might not be able to match the liability option terms. In other words, you might not be able to get the right strike price. Over-the-counter options are bought from a counter party on Wall Street. They can be tailor made to exactly fit your liability option, but bid ask differences can be wide. There are the liquidity and counter party risk issues.

Reinsurance is available. You can co-insure the entire product with a reinsurer. It used to be that you could reinsure the derivative portion of the product only. That has kind of gone away for a variety of reasons. Then there's dynamic hedging. I talked a little bit about that. In fixed-income portfolios, duration and convexity measure the exposure of the portfolio to interest rate changes. By monitoring and managing the differences between the asset and liability durations and convexities, a company can manage its interest rate risk. For equity derivatives, similar economic measures exist. These are called the Greeks because Greek letters are used to denote the measures. There are five of them. Delta represents the change in the value of an option portfolio with respect to the underlying index. Gamma is the change in Delta with respect to the underlying index. Delta and Gamma together are similar to duration and convexity in the fixed-income world. Theta is a measure of the time decay, how fast the option goes down as time goes by. Vega is the change in value of the portfolio with respect to volatility and Rho is the change with respect to interest rates. The five-year European option product we examined was at the money option for 72.3 units of the S&P 500 index. Based on the assumptions specified earlier, the Greeks for the option are as follows:

- Delta: 52.056 (per $1 change in the index)
- Gamma: 0.036 (per $1 change in the index)
- Theta: -7.272 (per 1 day change in time to maturity)
- Vega: 534.217 (per 1 percentage point change in volatility)
- Rho: 1,668.684 (per 1 percentage point change in the risk-free rate)

There are all kinds of dynamic hedging techniques available. Showing some of the more advanced techniques is beyond what can really be done here, but I'll show an example using Delta hedging. This is a popular method to protect an equity or a derivative portfolio. Delta hedging is implemented by matching the asset and liability Deltas using futures. As it turns out, futures have a Delta of just about one per unit of index. It's not exactly one, but for this example we're going to assume that the Delta is exactly one. The option in our example had a $24,043 value and you can see the Delta is $52,056 for this portfolio. So we're going to implement a strategy in which the company's not going to purchase any call options to hedge the derivative risk. Instead, it's going to purchase enough to mature the principal guarantee. So, we're going to purchase a zero-coupon bond for $75,957, and we're going to invest the money that we would have invested in options in cash and marketable securities. Because the liability option Delta is 52.056, , the company is going to enter into a long futures contract for 52.056 S&P 500 units because the Delta was one per unit. Actually, a futures contract on the Chicago Mercantile Exchange is for 250 times the index. So we're really purchasing about one-fifth of a contract.

Assuming that the S&P 500 increases from 1,100 to 1,110, the value of the liability option increases by $524, and the value of the futures contract increases by $521. In this case the value of the liability option and the value of the futures contract stay pretty close, they're within $3. However, if the market increases from 1,100 to 1,200, the value of the liability option increases by $5,386 and the value of the futures contract increases by $5206. In this case the liability option increases by a lot more than the value of the futures contract, and what's happening here is similar to duration in the fixed-income world. Delta's accuracy in predicting changes in the value of a portfolio decreases as changes in the underlying index increase. This brings up some issues with respect to Delta hedging. First, it's most effective when a company has a large book of business with offsetting risks. Delta hedging can present some major problems when there are some market disruptions. For example, at one point during the day of October 20, 1987, futures contracts on the S&P 500 were trading at about 20 percent below the actual index, and in these circumstances rebalancing the portfolio can be very difficult.

In order to Delta hedge, frequent rebalancing is required. You can't let the market run up by 100 points and then rebalance. You've got to monitor your portfolio and your position continually.

From a regulatory perspective, first for U.S. statutory valuation, equity-indexed annuity contracts are governed by actuarial guideline 35, which clarifies the actuarial guideline 33 treatment of equity-indexed annuity contracts. Actuarial guideline 35 requires projecting benefit streams, taking into account the liability call option. The reserve is the greatest present value of the integrated benefit streams.

For U.S. GAAP, equity-indexed annuity contracts are considered an investment contract and in most cases they'll fall under Financial Accounting Standard (FAS) statement 97 and they also fall under FAS 133. Under FAS 133, an equity-indexed annuity contract is considered to contain an embedded derivative—the liability call option. The embedded derivative is separated out or bifurcated from the host contract, so the equity-indexed annuity contract for GAAP purposes has two components. The first component is a host contract that will accrue at a fixed interest rate to the guarantee and the second is an embedded derivative.

In our example, the European example, our $100,000 premium was paid and the liability call option was valued at $24,043. So under FAS 133, we're going to subtract the $24,043 from the $100,000, giving us a host of $75,957. Then the derivative will stand alone. The host contract will grow to the principal guarantee of $100,000 at the end of five years. We're going to calculate the internal rate of return (IRR) to achieve this growth and that's 5.65 percent effective annual. Before, we showed 5.5 percent continuous, and this would be 5.65 percent, effective annual.

On each statement date, the value of the derivative is going to be calculated. For GAAP purposes, the changes in the derivative value because of market changes and the passage of time are considered interest credited for income purposes. The host contract's accrual from inception up to the guarantee is also considered interest credited. To see how this works, assume that we issued the product on January 1, 2001, and between then and December 31, 2001, the only change that occurred was the market went up from 1,100 to 1,200.

Table 1

EIA FAS 133

	Fixed Reserve	Derivative	Total Reserve
1/1/01	$ 75,957	$24,043	$ 100,000
12/31/01	$ 80,894	$29,429	$ 110,323
Reserve increase	$ 4,937	$ 5,386	$ 10,323
Interest credited	$ 4,937	$ 5,386	$ 10,323
Other reserve increase	0	0	0

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In table 1 you see the situation with the fixed reserve plus the derivative adding up to the premium of $100,000 on January 1. When we get to December 31, the fixed reserve has accrued at the 5.65 percent IRR for a reserve increase of 4,937. The derivative has increased, but really two things have gone on. First, the derivative has decreased because a year has passed by, but the market went from 1,100 to 1,200 and that more than offset the time, so the net increase in the derivative was $5,386. So putting this together, we have a total reserve increase of $10,323 and that entire reserve increase in this case will be considered interest credited and therefore it will hit the gross profit stream. Hopefully the company will have enough investment income in its portfolio to more than offset this policyholder interest credited, producing a net gross profit.

Now I'll discuss GMABs, which are contained in Canadian segregated funds and in some United States variable annuities. GMABs provide a return of principal floor regardless of how poor the actual variable fund performance is. Some GMABs have ratchet features that can go out to age 85 or even beyond.

For example, Product A is a deferred-variable annuity that requires a $100,000 single premium up front. We're going to assume that the product matures in 10 years, nothing happens in between, there are no surrenders, withdrawals, or deaths, and we're only going to permit investments in the S&P 500 index fund. Actually, as you know, for Canadian segregated fund products and U.S. variable annuities, many more fund choices are available. At the end of 10 years the contract holder is going to get back at least the premium, regardless of market performance. Let's say product B is similar to product A, except that product B only guarantees to return 75 percent of the principal.

The GMAB payoff from product A can be expressed as follows:

Max $\{0, 100{,}000 - AV_{10}\}$, where AV_{10} is the tenth year account value
$= \text{Max}\ \{0, 100{,}000 - 100{,}000 \times (S\&P_{10TR}/S\&P_0)\}$
$= \text{Max}\ \{0, [100{,}000 \times S\&P_0 - 100{,}000 \times S\&P_{10TR}]/S\&P_0\}$
$= (100{,}000/S\&P_0) \times \text{Max}\ \{0, S\&P_0 - S\&P_{10TR}\}$

There's no need to go through all of this math, but I just want to point out that this first line shows the maximum of zero and $100,000 minus the account value at the end of 10 years. If the account value falls short of $100,000, then there will be a positive payoff for the shortfall. If the account value goes above $100,000, then there will be a zero payoff. I've just done a bit of algebra on the next three lines to show that the value from this payoff at issue is equivalent to a 10-year at the money put option on the total return from the S&P 500 index for units equal to $100,000 divided by the initial index value or $100,000 notional amount.

The GMAB value for product B is a similar 10-year put option, but its exercise price, in this case, is only 75 percent of the initial S&P 500 index. For product B, the notional amount stays the same. The product still has a $100,000 notional amount.

In valuing this put option, we need assumptions similar to those we used for the European, Asian, and high water mark call options. We'll assume the current index level is 1,100, the option exercise price is 1,100 for product A and 825 for product B, time to maturity is 10 years, volatility is 25 percent, and the risk-free interest rate is 5.5 percent, continuous. In this case I'm also assuming that the dividends are zero, whereas before I assumed that the dividends were something greater than zero. I'm doing that because the fund holder or contract holder is getting the total return from the S&P 500 index. So the dividends are not reducing the fund growth in the case of this product. That's equivalent to my assuming that the dividend rate is zero.

I have used capital markets methodology to value this. There are several assumptions that are contained in this, one of which is a constant volatility of 25 percent. I realize that that's a little bit questionable. Among the more modern techniques used are the stochastic volatility or regime-switching models, calculations such as in reserving for Canadian seg fund products, and we'll talk about that just a little bit later. Using the methodology that I have: for product A this feature costs about 8.27 percent of premium; for product B, which has a much lower strike price, it's 3.67 percent of premium.

Companies cover the cost of GMAB by assessing explicit or implicit charges against the account value. Hedging GMABs is somewhat difficult. GMABs are long-term guarantees. A maturity guarantee of at least 10 years is very common and some contracts have features that extend the GMAB to a very high attained age. The reinsurance market for GMABs is very thin.

Capital market volatility protection is available for, at most, five to seven years, and there's a very large basis risk problem, because Canadian seg fund products and variable annuities offer a variety of fund choices. The actual funds may not track well with the indexes used for options or futures contracts. In other words, the hedging techniques that could be used to protect against the GMAB risk may not follow the actual funds that are used for variable annuity or Canadian seg fund investment very well.

From a regulatory perspective, there's the U.S. statutory Variable Annuity Guaranteed Living Benefits Task Force (VAGLB) that has developed actuarial guideline MMMM, which is still in draft form. I guess it's expected to be passed in 2002. It is the clarification of AG33 for variable-annuity guaranteed living benefits. It requires stochastic testing, running multiple scenarios under historical market returns, and volatility. The reserve under AG MMMM will be the greater of the integrated Commissioners Annuity Reserve Valuation Method (CARVM) reserve for the entire contract including the VAGLB (the GMAB in this case), and the reserve that would be held in the absence of any GMAB.

Canada has a procedure that's been in use since 2000, and it was a result of a CIA task force report on seg fund products. This requires projecting the asset and liability cash flows under stochastic scenarios, assuming historical market returns and volatility. It's really like a gross premium valuation. The policy liabilities are established by ordering the scenario results and then calculating appropriate conditional tail expectations. A conditional tail expectation (CTE) 80 means that you're going to throw out the best 80 percent results and you're going to look at the mean of the worst 20 percent results. Also minimum capital floors have been established by the CIA task force based on its methodology.

In the Canadian work, there is a lot of investigation of modeling stock indices or equity movements over a period of time, and in examining the tails of various distributions. The log normal distribution does not do a good job in modeling the tails of equity movement distributions. However, for capital market option valuation, the Black-Scholes model, which assumes log normal movement, is what's used by most players on Wall Street.

As far as U.S. GAAP, FAS 133 applies to GMABs. It's the guaranteed accumulation benefit that is considered an embedded derivative or put option. The GMAB must somehow be separated from the host contract. I'm aware of two practices permitted by the accounting firms that audit the client companies. The first practice is similar to what one would do for an equity-indexed annuity. With this practice you calculate the fair value at issue of the GMAB and then reduce the host. Even though it's a variable annuity, reduce the value of the variable annuity at issue by the amount of the derivative. Then calculate the IRR to accrete the host to the GMAB guarantee at maturity. Value the GMAB at each statement date. The reserve is the value of the host plus the value of the GMAB.

Another practice is to calculate a separate reserve for the GMAB based on the present value of future benefits minus the present value of future risk charges under stochastic scenarios. In this case we're not going to reduce the host, we're going to just leave the host alone, and on each statement date we're going to revalue the GMAB reserve. So the entire reserve for the contract will be the variable annuity plus the reserve for the GMAB.

MR. LARRY H. RUBIN: I will focus on embedded derivatives in risk products. Level premium products contain embedded call options, and for those who remember the late 1980s and the early 1990s, embedded call options caused a number of financial difficulties for insurers.

We're not going to illustrate where these options exist, but how they can be hedged, and not only that, but how they could actually increase the returns while they get rid of this risk. It's one of the areas we find a place to get paid for getting rid of risk.

I remember when I was taking my fellowship exams in the mid-1980s, a very common question was do you have the pricing considerations for product XYZ? (You can fill in XYZ with any product you want.) The question came up so often that a candidate simply knew the answer—interest, a conservative long-term rate should be used. In the early to mid-1980s, most product development consisted of setting a long-term interest rate as low as possible. Maybe as much as 600 to 700 basis points lower than current market rates. To the extent that earnings exceeded these rates, the excess was returned to the policyholder in dividends, excess interest credits, or some other feature that gave the company the flexibility to pass on these excess investment earnings in a discretionary manner to the policyholder. The discretionary manner of these credits required that the policyholder have a high degree of confidence in their insurer's willingness to pass on these discretionary credits.

A number of products today, and particularly those focused on long-term care, guaranteed level term, and disability income, contain features that do not allow the passing on of these excess investment credits. Competitively, this requires the actuary to not be what sometimes is called overly conservative when determining the conservative interest rate. What's not clear is the difference between a conservative rate and an overly conservative rate. Even today, what is a conservative rate anymore?

In the early 1990s, the state of New Jersey would not approve a long-term-care rate filing if a loss ratio was computed using a rate lower than 7 percent. At that time, the state of New Jersey and a number of actuaries figured 7 percent was a very conservative long-term rate. Very few people today think a 7 percent rate is a very conservative long-term rate. It's very possible ten years from now that we may look back at the 5 and 6 percent rates we're pricing with today the same way we now look at 7 percent.

My presentation applies to any product that has level premiums and little or no surrender value. I'm going to focus on long-term care to illustrate this presentation. Now, I think the Actuarial Standards Board requires I disclose my assumptions, which can be seen in Table 2.

Table 2

Long-Term-Care Insurance

Long-Term-Care Assumptions

Issue Age	65
Premium	$2,455 Net Premium is 70% of Gross or $1,718.50
Incidence Rate	70% of SOA LTC Ins Val Methods Task Force Table Male
Pricing Interest Rate	5.5%

7-Year Benefits Period
Benefits are 100 per day in Home Care or Nursing Home increasing 5% per year
Home Care Benefits are received 4 days per week
Benefits incurred due to loss of 1 ADLs or Cognitive Impairment
Select Factors (20-Year select period linear)

Year 1	5.00%		
Year 2	10.00		
Year 3	15.00		
Year 4	20.00		
Year 5	25.00		
Year 6	30.00	Year 7	35.00
Year 8	40.00		
Year 9	45.00		
Year 10	50.00		
Year 11	55.00		
Year 12	60.00		
Year 13	65.00		
Year 14	70.00		
Year 15	75.00		
Year 16	80.00		
Year 17	85.00		
Year 18	90.00		
Year 19	95.00		
Year 20	100.00		

Elimination Period	90 Days
Lapse Rates	2.00%
Mortality	Annuity 2000

Assume Claims Incurred End of Year

I priced an age 65, 5 percent per year increasing benefit policy under these assumptions (Table 2). I'm going to focus on the interest rate assumption of 5.5 percent. If we construct an asset share model (Chart 2), we can see the cash flow patterns of the policy.

For 19 years the company receives a greater amount of cash than it pays in benefits to policyholders. At year 20, they began a cycle of disinvestments so that by the time the policy matures, the total asset balance will be zero. Since this policy is priced at 5.5 percent, the company is, in effect, agreeing at point of issue to sell the policyholder a series of bonds yielding 5.5 percent. Although the policyholder will decide to exercise or not exercise an option based on whether he feels he needs coverage, there are times it will be exercised to the detriment of the insurance company.

In Chart 3 we show the asset build up of the policy at various rates of return. As long as assets are above the line showing the pricing rate (5.5%), the company can mature its obligation. If it's below the line, the company cannot mature its obligations and needs to take action from some other place on the balance sheet. The top line shows the asset growth if rates stay unchanged, in this case 7 percent. This is probably the asset share first shown to management when the actuary made a business case for why they should enter long-term care. As actuaries we would typically label the 7 percent scenario as our best guess and the 5.5 percent scenario as pessimistic.

The cost of the call options we embedded in our product is missing from our asset share analysis. I asked our derivatives desk to price a series of call options guaranteeing that the policyholder would get 5.5 percent on all these bonds.

If we subtract out the price of the call options, our asset share moves from the top line to the second line, which is still a good story to tell management and probably a little more reflective of the true costs of the policy. The real issue is what happens if the policyholder exercised his or her option to the detriment of the company. The bottom line shows the same asset buildup at 5 percent. As time goes on, the difference between the 5.5 percent line and the 5 percent line widens and the company begins to show a greater and greater loss.

Now, at this point, aside from translating from actuarial terminology into capital market speech, I haven't really told you anything you don't already know. You all know that if you price a product at 5.5 percent and you only have 5, you'll have a loss. The real thing you want to know is can I hedge this risk and not only can I hedge this risk, but can I guarantee my returns? I'll go into some strategies. I know of five strategies companies have investigated in the past to manage these embedded calls, particularly as they relate to long-term care. I'm going to start with the most frequently used strategies and then go on to the more effective strategies.

Probably the most common strategy is to assume a rate increase. How many of you believe today that if you went to your management and recommended a rate increase because interest rates were approaching the level you assumed in pricing, you'd get your management to go along? How many of you believe you would wait because interest rates will eventually rise? How many of you believe you'll know the time comes when rates will go below your pricing level and stay there? How many of you know of a company that has felt its rate increase recently on business it wrote ten years ago because current market rates are at or below the level it assumed in their pricing? If you can correctly decipher the point where interest rates fell below pricing and stayed there, and if you can convince your management of such, how many of you believe regulators would give you a rate increase in a timely manner? So based on this survey, how many of you believe that this is a viable strategy?

Let’s go to strategy two to assume your risk's offset. I have this product through which I lose money if rates fall, but I also have this big annuity block. As you know, if rates fall, I’m going to drop my credited rate and have a huge gain. Shouldn’t that offset my loss in my long-term-care block? Let’s think of a rate not just falling in an interim period or fluctuating, but a long-term decline in interest rates with a level of interest rates over the next decade of 4.5 or 5 percent. What’s going to happen to those annuity assets? They’re ultimately going to roll over. Eventually that gain disappears. This thing goes on for 40 years, so clearly this strategy, while it may work for short-term fluctuations, is not going to work as a long-term risk management strategy.

Strategy three, which is a more effective strategy that some companies I know of have implemented this year and prior years, is one of offsetting derivatives. The call option is equivalent to a series of future starting interest rate swaps. I don’t want to get into the method of proof, because I’m not sure I could do the math to prove it, but we’ll take that at face value. For example, when you closed out this position by entering into an offsetting series of forward starting interest rate swaps, let’s assume I have $100 million in long-term-care premiums coming due in three years. My risk is that three years from now my rates will be significantly lower than the rate I assumed in pricing this product. I’m going to enter a three-year forward-starting interest rate swap with $100 million in notional value, where the insurance company would receive fixed and pay floating. I witnessed a similar swap on July 25, 2001, and the fixed rate was 6.67. So three years from now the company will receive 6.67 percent of $100 million from the swap counter party and pay the swap counter party whatever the London Interbank offered rate (LIBOR) is at that time and LIBOR will change each quarter thereafter.

Now that we have the swap on the books, we have to do something with it when the $100 million cash comes in. Let’s see what we can do. The simplest way to understand this is to just buy a LIBOR floater. In this situation I have an asset paying LIBOR. I pay my LIBOR through the swap counter party and in the end I’m going to earn 6.67 percent for the next seven years. While this is an easy way to understand it, the one problem with the strategy is that companies typically want to investigate a credit spread over swap rates and there is really no credit spread beyond what you could get in a LIBOR floater. LIBOR floaters tend to be very high quality and have very narrow credit spreads. Additionally, they also tend to be in short supply.

Let’s look at some other ways to do it. If this works economically, I should just be able to unwind the swap, and under statutory accounting, an interest maintenance reserve (IMR) would just take any gain or loss over the life of my instrument and I should be fine. This strategy would work great if there were no such thing as federal income taxes and we had an accounting paradigm that truly reflected the economics of the business, neither of which I think is true.

Let’s go into our third way of dealing with this flop. It’s to enter into an offsetting swap agreement and buy a credit instrument. Here's where I'm going to get into complicated mathematics. The company receives a LIBOR rate and has agreed to pay LIBOR to swap counter party one three years ago. Today I enter an offsetting agreement in which I'm going to receive LIBOR from swap counter party two. If I'm receiving LIBOR and paying LIBOR, it nets to zero. I'm going to buy a fixed rate asset that's going to pay the current swap rate plus a credit spread over that swap rate. From now on, during the rest of the presentation, I'm not going to refer to the traditional way we think of credit spread as a spread over treasuries, but I'm going to refer to a credit spread as the spread over the swap curve. My swap current rate is going to be paid to swap counter party two in exchange for the swap I just entered. So what I'm left receiving is a swap forward rate plus a credit spread, or in this case, I'm going to receive 6.67 percent of my $100 million plus the credit spread that is available in the market at the time the cash comes in.

From swap counter party one we receive LIBOR and pay it to swap counter party two. We then receive a swap forward from counter party one and pay the swap current to counter party two. We then receive from the asset the swap current rate, plus the credit spread. Netting the difference, the swap current cancels and we have the swap forward plus the credit spread.

I know of a number of companies that have looked to implement the strategy, some which have, and then there are other companies that have raised a couple of concerns with the strategy. One is the large counter party exposure represented by this strategy. Counter party exposure is the failure of the counter party to perform under a derivative agreement. It is really a form of credit risk. In this situation then, I'm taking credit risk in three places. I have three times the credit exposure than if I just bought the asset. Now, granted, swap counter parties seem to be very highly rated, so your credit risk is nowhere near the three times, but it is certainly greater than just buying the credit instrument.

More important to some of our clients has been the inability to lock in today's credit spreads. I remember from when I used to price products that you'd start not by looking at the swap curve, but you'd look at what kind of portfolio rate you would expect to generate. That would be a combination of the swap rates plus whatever credit spreads the investment area itself could get in the market.

Today, credit spreads are historical highs. A lot of companies can make a lot of their pricing bogies because of this credit spread. To illustrate this further, the difference in yield between Bloomberg's A2 average and the 10-year swap rate going back to 1991 is 29 basis points, with a standard deviation of 15 basis points. On October 8, 2001, that spread was 90 basis points. So, it was more than three standard deviations above the historical level. Companies have been looking for a way to try and capture the 90 basis points that exist in today's markets.

The other strategy companies have looked at is securitization. I think there was an article recently in *The Actuary* on the benefits of securitization. Chart 4 shows ten years of the cash flow diagram we presented earlier and the amount of the cash flow that's represented by the premium.

The idea behind securitization is to package the premium cash flows and sell them into the capital markets. In this case, I am now going to receive the bulk of my cash up front where I can now invest it at today's rates. This is something that's probably been investigated by companies going back to the mid-1980s. In trying to find a way to do this, there have always been accounting problems associated with it, but more important is its inflexibility in the accounting strategy of handling adverse deviations.

A long-term-care policy or any level premium product with little or no cash value (such as level premium term policy or disability income policy) is a lapse-supported policy. When the policy lapses, the reserves are released to the company. The company depends on a certain amount of this reserve release to meet its pricing target. If lapses are lower than expected, the company needs to set up additional reserves, higher than they expected. If, in addition to doing that, they've sold the cash flow, they've just exacerbated their problem.

I think we can look at what securitization attempts to do to come up with another strategy. This is a strategy that is new this year, and a number of companies are attempting to implement part of it at the end of the year. This is a structured liability. Under the structured liability, we're going to actually construct a product that has an offsetting cash flow and, therefore, eliminates our call. The structured liability can be thought of as a combination of securitization and forward-starting swaps. Refer back to Chart 2, which shows that our long-term cash flow into the years has to be invested at 5.5 percent in order to generate the needed assets. Under a structured liability, there is another cash flow, so it looks like Chart 5.

Now, because of a scale on this graph, it's hard to see that this is actually the mirror image of Chart 2 after the first year. The performance of this liability, in the end, does not depend on my long-term care, but it just happens to mirror it. So in aggregate, I now have a new combined cash flow that looks like Chart 6. Now, I've moved my cash up front where it can be invested at today's rates and get today's credit spreads and cash flow to match my block.

What ends up happening can be seen in Chart 7. If you remember, the 7 percent New Money Rate line was our original best guess pricing line. By combining these products and creating another liability that has in itself a profit charge in it, I move up to the top line. And if rates were to fall to 5 percent in coming forward, I'm still better than my 5.5 percent pessimistic pricing assumption. This graph shows some other benefits. We're going to reduce our risk of declining rates for nonputable liabilities. You take advantage of the positive slope of the yield curve to increase earnings. In this case it's almost doubling the earnings. Because we're moving our cash up front, we now have increased our assets under management. While it does involve derivatives, we minimize their use, and therefore we minimize any FAS 133 implications and we've eliminated most or all, of the problems of securitization.

Here we have a combination of forward-starting swaps in securitization and we get all our advantages of the securitization strategy. Also, there's no leverage impact and we maintain all our flexibility for handling adverse deviations.

MR. WILLIAM BUGG: I have a question on the structured liability. I wonder if you could discuss it in a little more detail and explain how you do this.

MR. RUBIN: There are a number of ways we do it. Sometimes it's set in reinsurance; sometimes it's done by selling annuity products.

FROM THE FLOOR: I'm thinking back to the management group you were talking about that was inflexible in seeing those rate changes. Doesn't it seem that flexibility is implied here? When you remove the risk, you also remove the upside if rates do go back up and so there's a greater need to move your product prices in that dull environment. So you fix the in-force problem, but as interest rates change, you need to rapidly change your products' rates so that when you're locking in rates you're locking them in at what you're pricing at.

MR. RUBIN: Yes. Today you could actually still get close to 7 percent because of the credit price spreads, but you might be locking in lower rates later.

MR. DANIEL: I guess my question was as to the reality of being able to move your product rates rapidly.

MR. RUBIN: I don't believe you can get to that point because of the time delay in long-term-care rate filing which can take nine months to a year. I don't think you can price right at the current rate with no margins for the impact of rates swapped over the year. I do believe that you have the ability to look at today's market rate and price a little closer to it and typically the 200 to 250 basis point spread that, when I was a pricing actuary, I used to use in order to be conservative because I had a 40-year liability.

MR. MARK BURSINGER: One of the disadvantages you listed of the pure derivative strategy was the inability to invest in today's markets at historically high credit spreads. Do you have any comments on how that will be matched up with historically high credit losses? If we believe in an efficient market, we would be indifferent between today's credit spreads and tomorrow's.

MR. RUBIN: The aggregate cost is probably somewhere in the neighborhood of 50 basis points. I believe there's really a multiplier factor in the spreads and I'm not sure the market is really efficient based on default rates. They're more based on supply and demand and short-term perceptions of the market including long-term credit outlook.

MR. DAVE INGRAM: I have a quick question on the equity-index embedded derivatives. The product's sold as if it's buying the index and buying a put option. But that's not something anybody ever considers doing to actually hedge an equity-indexed annuity.

MR. HAMBRO: I think most companies would purchase a call option or at least construct a replicating portfolio that mirrored the call option.

MR. INGRAM: Maybe I didn't say what I meant. I meant buying the index itself and a put option.

MR. HAMBRO: The only thing is there would be a very large risk-based capital (RBC) charge with it.

MR. INGRAM: That's probably so. That just means that the RBC doesn't make any sense if you have two economically equivalent strategies and one has a huge capital requirement and one has a relatively low one, doesn't it?

MR. HAMBRO: But the way the RBC is formulated, you'd be holding a significant amount of RBC. I don't believe that anyone is doing that.

MR. INGRAM: Even though RBC is coming down on equities, it's still not going to be low enough to make it worthwhile. But, it seems like an issue that should be raised with the people that are setting the RBC.

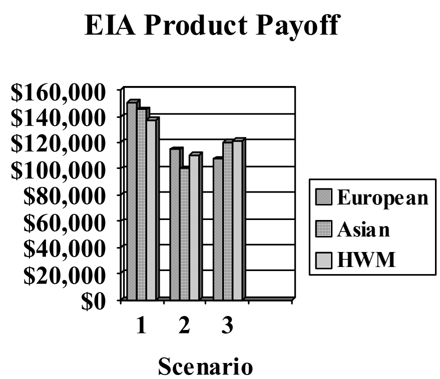
MR. TIMOTHY HILL: Is it still the opinion of the powers that be that the GMIBs, GMDBs, and any kind of guaranteed payout floors are going to be excluded from FAS 133?

MR. HAMBRO: Well, the thinking is that GMDBs are considered traditional insurance. As for GMIBs, I hear different things at different times. Sometimes I'll talk to people that are well connected and they'll say it's in and sometimes they'll say it's out. I don't know as of today whether it's in or out. As far as the different payout products are concerned, it depends on whether there are significant insurance features or life contingencies. Some of this is kind of an overlap with FAS 133 and the AICPA Non-Traditional Long-Duration Contract Task Force as to how all this is going to work in GAAP context. The long duration task force working on nontraditional products is deliberating and as of yesterday, I heard that we may have an exposure draft in late 2002 or early 2003. To answer your question in a roundabout way, GMDB will be covered by the long-duration task force. GMIBs may be excluded from FAS 133, but maybe not, and other products depend on what the insurance feature has to be.

Chart 1

EIA

Comparison of Product Payoffs
3 S&P 500 Scenarios



S&P 500 Index Values

Scenario Year	1	2	3
0	1100	1100	1100
1	1200	950	1100
2	1350	800	1200
3	1475	1100	1500
4	1625	1200	1350
5	1800	1300	1200

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Chart 2

The following graph shows net premium plus coupon income less benefit cash flows over the first 25 years of the policy.

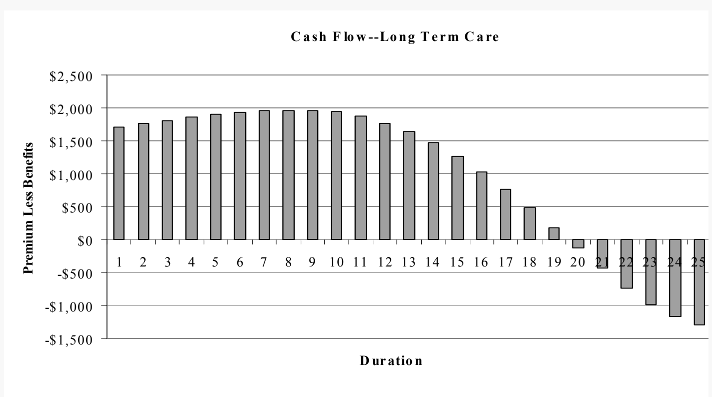

Chart 3

Asset Growth if future new money rates are 0.5% below pricing

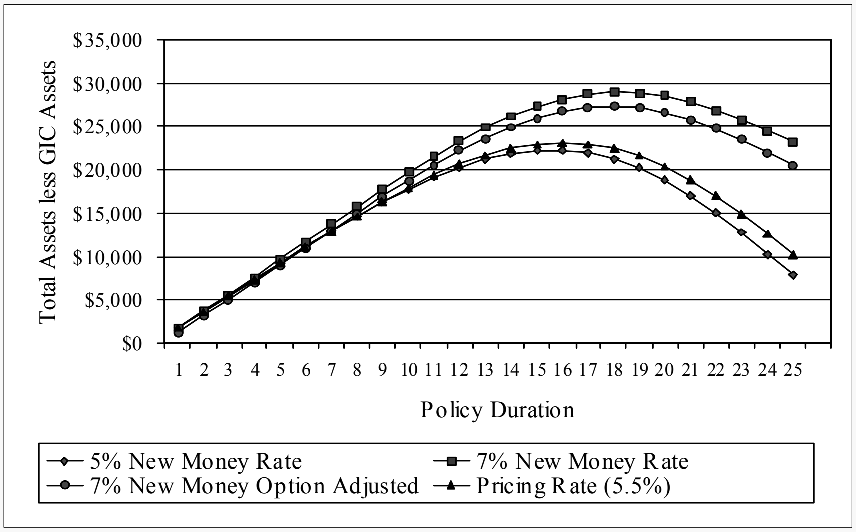

Chart 4

Total Cash Flow and Premium Cash Flow (first 10 years)

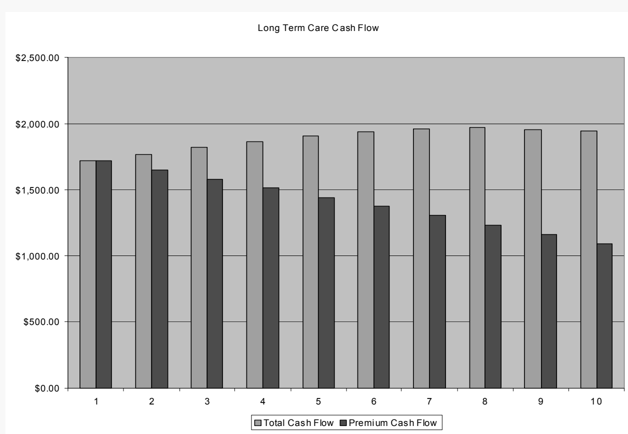

Chart 5

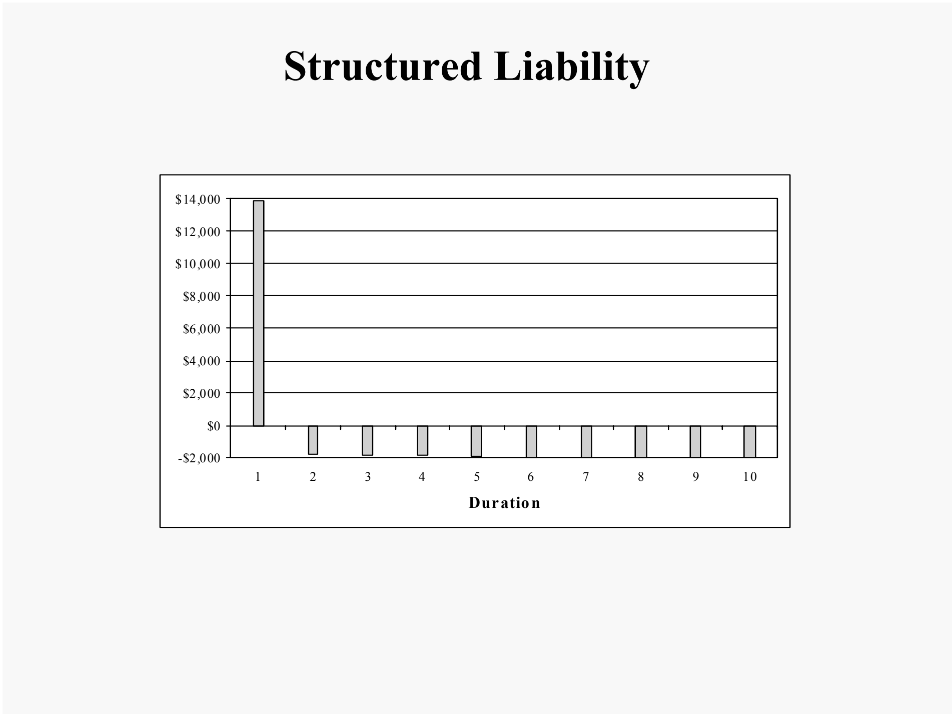

Chart 6

Structured Liability

Cash flows are re-engineered so the bulk of the cash is received up front where it can be invested at today's rates, reducing the potential impact of a fall in future rates.

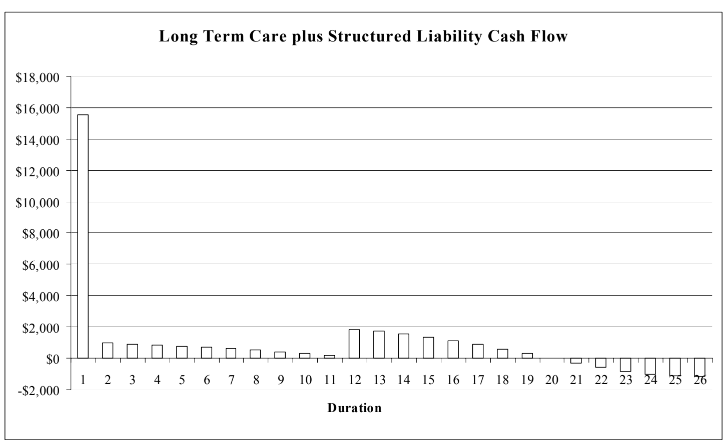

Chart 7

The following chart shows the benefits of the strategy by comparing asset growth with and without the strategy under both the level interest rate scenario and the declining interest rate scenario.