

**1998 VALUATION ACTUARY
SYMPOSIUM PROCEEDINGS**

SESSION 35PD

EQUITY-INDEXED PRODUCT MANAGEMENT

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Craig Fowler

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EQUITY-INDEXED PRODUCT MANAGEMENT

MR. MICHAEL J. HAMBRO: Equity-indexed annuities have been in the marketplace for about three years, and they've sold quite well. However, a very low interest rate environment (which causes companies to not have a large amount available to purchase the equity options necessary to grant the policyholder's participation in the market) combined with high stock market volatility (which causes the counterparties that we deal with on Wall Street to charge very high option prices) has caused a lot of pressure to be placed on the profitability of equity-indexed products.

At the same time, there's intense competition out there. Therefore, companies are trying to keep the policyholder's equity participation rate competitive.

We have two speakers that are going to address these issues. Jeff Poulin is senior vice president at London Life Reinsurance Company in Philadelphia. He is responsible for the U.S. life and annuity reinsurance. His involvement includes single-premium deferred annuities, immediate annuities, variable annuities, equity-indexed products, guaranteed maturity benefits and guaranteed minimum death benefits. Jeff is going to discuss product design in connection with index or interest crediting strategies and managing earnings during times of economic volatility.

Craig Fowler recently became director of analytics and strategic services at SS&C Technologies in Windsor, Connecticut. Craig's role will be to help expand the asset analytic capabilities across a wide range of SS&C products and to be involved in the consulting side of SS&C. Prior to joining SS&C, Craig was director of portfolio management at Mutual Life of Canada.

MR. JEAN-FRANCOIS (JEFF) POULIN: I'm going to start with the product design. In a typical product you get a certain amount of money that you need to pay your up-front costs, commission and administration expense. Then you need to cover your fixed-income side, which is your minimum

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guarantee at the end of the term. Usually it's 90% of premium, accumulating at 3%. The remainder is invested in options, that will determine, essentially, your budget for the option side and your index guarantee to give to the policyholder.

The one thing you don't want to forget is, obviously, profit. It should come from the fixed-income piece. I think it's much better to try to design the product so that you not only meet your minimum guarantee. However, you also meet your profit target and any renewal expense that are true to fixed-income fees. Then look at the remaining money for the option portion of it.

The variation in lapse can cause gains or loss over the term of the policy. Volume is a critical issue. If you don't get volume, it's really hard to buy the over-the-counter (OTC) option. You're basically left with the traded options or an option replication methodology. If you're going to buy futures, there's a certain volume issue.

There are really three designs out there. There's an annual ratchet, a point-to-point, and a high watermark. There are some variations of those, but these are the main designs.

Most companies for point-to-point and high watermark will try to buy custom design options or OTC options. By doing that, they are locking in up-front, the volatility and the interest rate risk of the option side. There's less of that risk and more of the lapse risk. You're taking a guess at what your lapses are going to be for the term of the policy. That's what you really worry about. If you get less lapse than expected, then you'll be underhedged.

With the annual ratchet, companies are usually buying traded options or using an option replication methodology. You're exposing yourself a little less to lapse. You just buy options for the people that are remaining on an ongoing basis. You sort of manage the lapse that way. You expose yourself to volatility in interest rates, which would affect the price of your hedging. So as volatility and interest rates increase, the cost of hedging goes up. That's the risk you're dealing with. So when you think about designing, you need to think about these risks, and which one you're more comfortable with.

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There are typical features of an equity-indexed annuity that you need to think about. First, is the term. The longer the term, the cheaper the option. That's something you need to take into consideration. Typically, you see five-year and seven-year terms, but now we are more often seeing ten-year terms as volatility and the cost of hedging increase. Many people are coming out with ten-year terms. The index that most companies are using is the Standard and Poor's (S&P) 500. I think there's a product that I'm aware of that uses the Dow Jones. If you want to distinguish yourself, you might want to use the Dow Jones rather than the S&P 500. The general population relies more upon, or is more aware of the Dow Jones than it is of the S&P 500.

You need to think about a participation rate or spread and how you're going to manage that. The variation in participation rates in the market right now is amazing to me. There are a lot of different products out there. For participation rates, you're offering a certain percentage of the increase in the market. If you're using a spread approach, essentially, you're giving the market return minus a certain spread on an ongoing basis.

Averaging is another feature. It's actually, in my opinion, a nice feature. Consumers like it. They like not being exposed to a sudden drop in the market. It makes hedging less costly. What you have to watch for is long-term averaging, which essentially reduces the potential upside to the client and the expected return.

Floors and caps are also used. You need to think about that. If you use caps, it reduces your cost, but it sort of diminishes the length of the stock market. So you need to think about these issues.

Vesting is important, especially if you're going to have the high watermark or the point-to-point. I think you can use vesting to sort of match the market value of your option on an ongoing basis. So that's a feature you want to think about.

On the surrender charge side, most people are using a surrender charge of 10% of the initial premium for the term. Some people are using an SPDA approach in which a surrender charge reduces in over time.

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Let's discuss marketing material. The regulators have come up with this balancing language idea. I think the regulators have stopped worrying about companies managing the product very well to market conduct issues. They're coming up with a couple different things that people will have to worry about. This balancing language concept says that if you're going to prop up a positive point in your equity-indexed annuity, you always have to talk about the downside of it, too. The example I've put there is averaging. It diminishes the downside if there's a large drop in the market, and in the last few days. It also reduces the expected return on an ongoing basis. It also specifically states that you can't say risk-free in your marketing material.

When you look at the sale of these products, you need to make sure that your sales force is well-trained. Being a reinsurer, I've seen a lot of different approaches that range from absolutely no training, in which the policy is just sent out, to very good training and very good sales material. The first approach is probably not the appropriate one if you worry about market conduct issues.

The market performance today is forgiving a lot of sins. This is something I heard from an Aegon executive, so I'm not going to take credit for that quote. But I thought it was a very good quote. I think it doesn't matter what your design was in the last two years because the market has done so well. I prepared this speech a month-and-a-half ago, and the market has had a couple of hiccups since then. I know of a product out there that has a five-year term and a five-year averaging product. On an expected basis, it gives you two-and-a-half years of return in the stock market. I don't believe that people that are buying the product understand that concept. If it's not well explained up-front, you may have problems down the road. Now, because the market has done so well, people may still look at their product and be happy with it, but it probably won't continue forever, so you have to be concerned about that.

The NAIC is coming up with a buyer's guide that will have to be released at sales. It explains the different terms that have to do with annuities. It's quite well done. It also proposes questions for the policyholders ask the agent. It's a nice piece of material, except that it's very lengthy. So I'm not sure that people will read it.

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When you're thinking about design consideration, there are some points you have to consider. Simplicity is first, and I think, most important. It's a very complicated product. Once you've seen one, you've only seen one. There are many differences in terms of design features. I think that companies should focus on making it easy to understand and easy to sell products, rather than making them complicated products. Actuaries have a tendency to like complex problems, but the average guy out there needs to understand this policy when he buys it.

You need to think about accounting. Are you able to handle the accounting on this? Do some testing on the accounting. Make sure that you're not going to get wide swings in results that won't be good for your company. You should test many scenarios to make sure you're covered there. Hedging is another consideration. Can your company handle it or can you find somebody who can do it for you?

Regulation is also important. You need to make sure that these products are allowed in your state of domicile. If you're in New York, it's pretty hard to offer the product. You also have to think of these assets you're thinking of buying. What are the limits in your state of domicile? Are you allowed to buy these assets? I'm in Pennsylvania, and the rules about buying derivatives are very stringent there. So you have to look at all these regulations when you think about that.

Another design consideration is administration. Can you handle it? These products are hard to administer, and you need to think of all of this before you go ahead. Many companies are issuing only once a month or once a week to try to avoid having multiple problems in terms of looking into your hedge versus your liability. I think limiting issue dates is a good idea. So you need to think of all these things.

Volume is the last consideration. Are you going to write enough of this to make it worth your while? Are you going to write enough of this to be able to purchase the derivatives you want to purchase to protect yourself?

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I want to talk about the crediting strategy on these products, or the setting up of the participation percentages on this product. I'll go through examples of three different products: a one-year ratchet, a high watermark, and a point-to-point. We'll look at the different issues for the different products in terms of explaining to the policyholders what they're getting in terms of return.

What we're going to do is start with this product which has a premium of \$1,000. The surrender charge is 10% of initial premiums during the whole term, and then it drops to zero at the end of the term. The term is seven years. I'll get to the vesting schedule later for the point-to-point and high watermark. The one-year ratchet is vested in the first year. The participation rates I'm going to use are as follows. In the first year, I'm going to assume that market gains are 15%. The second year, I'm going to assume a drop of 5%, and we'll see what that does in terms of your crediting strategy.

On the one-year ratchet, we have an account value. The account value at the end of the first year for a 15% increase is just half of that 15%. Your participation rate is 50%, so you're account value is \$1,075. The surrender value is the maximum between account value minus the surrender charge of 10% of the original premium, or the minimum cash value, which is \$900, accumulating at 3%. So you get a surrender value of \$975. It's pretty straightforward.

On the discrete look-back, I've assumed that you have the 15% times 60%, which is the participation rate. Then I've assumed that the vesting schedule becomes your highest point, but you're only earning one-seventh of that at this point. You have to look as if it was the highest point over your seven years. You then calculate the rate for seven years and just take the one year's worth. It gives you an account value that's fairly low. It's only 1.2% higher than the initial account value. Many products that are look-back types work like this. This is hard to explain to the policyholder. The market went up 15%, yet you're getting only a return of 1.2% on your account value. The surrender value is your minimum surrender value.

Discrete Look-back (first year):

$$\text{Account Value: } \$1,000 [(1 + (15\% \times 60\%))^{1/7}] = \$1,012$$

$$\text{Surrender Value: } \text{Max} [(\$1,012 - \$100), \$900 \times (1.03)] = \text{Max} (\$912, \$927) = \$927$$

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On the point-to-point interest crediting, I assumed that that latest point is your last point. I've done the adjustment for the one-seventh. That sort of matches the market value of your option where the intrinsic values are. It helps accounting to use this kind of vesting schedule. Again, there is a lousy return, 1.4%, despite the market return. Again, there is a minimum surrender value.

Point-to-Point (first year):

Account Value: $\$1,000 [(1 + (15\% \times 70\%)) ^ {1/7}] = \$1,014$

Surrender Value: $\text{Max} (\$914,927) = \927

In the second year, the market drops 5%. For the one-year ratchet, the values stayed the same because the market dropped.

On the discrete look-back, you look at the high point. So your highest point is still the 15%, but now you've accumulated for two of the seven years. So your account value is going up despite the fact that the market went down. So the policyholders will be happy with that if they are able to understand why the value went up so little in the first year. Surrender value is still the minimum surrender value.

Discrete Look-back (second year):

Account Value: $\$1,000 [(1 + (15\% \times 60\%)) ^ {2/7}] = \$1,025$

Surrender Value: $\text{Max} (\$1,025 - \$100,955) = \$955$

On the point-to-point, you have the 1.15 the first year, and then you drop it 5% the next year. Then you calculate your rate of return, and accumulate it for two years. You get a value that goes up despite the fact that the market goes down. You're going to have some explaining to do to the policyholder. What I'm saying is, in the first year, you have to explain to the policyholder that the value has gone up only 1–1.5% despite the market return. So one of the things the companies are doing is showing projections. I think it's very powerful to show projection. You can continue at the same rate as the most recent year, and 15% is quite aggressive. It will show them a nice value. You might want to project it at 7%, which is a more reasonable rate. Then you can show, if the market

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stays flat from here, what you would get in the end. I think these projections help the policyholders understand what they're getting into and why the value doesn't go up.

Point-to-Point (second year):

$$\begin{aligned} \text{Account Value: } & \$1,000 [(1 + (1.5\% \times .95\% - 1) \times 70\%)]^{2/7} = \\ & \$1,000 \times (1.06475)^{2/7} = \$1,018 \end{aligned}$$

$$\text{Surrender Value: Max } (\$1,018 - \$100,955) = \$955$$

You can also send a letter explaining why this happened or do a combination of the two. I've seen some of these letters that have come out at the first renewal. Many of them are quite confusing, and I think that the policyholders might get upset with a letter that's not well done. So you have to watch for that.

You can also do nothing. There's no regulation that tells you you have to do anything. You bought the OTC option, which is a lapse-supported product for the most part. If people want a lapse, it is probably a good thing from a profitability perspective. You have to watch for market conduct.

You can also have your agents explain the results. I think most agents will do it if they get a trailer on this. They probably won't bother if they don't. It can be the most effective method if your agents are well trained.

Another problem with the participation percentage is that your initial fixed-income market (interest rates are currently low) fixes your budget, essentially, for buying options for the remainder of the term. You have to take that into consideration. If you have an OTC option, you don't worry too much about the volatility and the interest rate affecting the price of your option. You need to worry about lapse the most. Essentially, if people lapse, you want to have assets that are worth what people are due under the cash value. That's why you need a vesting schedule that sort of matched the market value of your option to a certain extent. I think that a well-designed product can do that. You can get away with it.

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These OTC options are not easy to trade, but there are ways that you can make them very marketable. You can ask firms to give you collateral. You can deal with three or four different houses. If you get three or four different houses quoting on these options on an ongoing basis, and that collateralizes them, then you create a very marketable security that you can sell back at any time, which can be handy.

For OTC longer-dated options, as I said, the main risk is lapse. If the lapse is higher than assumed, you have a gain or loss on the fixed-income portfolio. You also have a gain on the option residual value, and you become overhedged. You have a gain on the surrender charge or the vesting schedule. If the lapse rate is lower than assumed, you may have a loss on the option. You have to be concerned about that. It's somewhat lapse-supported, and you'll want to have the right lapse assumption. Traded options or an option replication strategy are often used for one-year ratchet design. You have to worry about volatility and interest rate level. You can manage that somehow with your participation rate, but you have to worry about what higher lapses do to your participation rate. If you have higher lapse than expected, is that profit for your company or is that something you pass onto the policyholder? You should have some sort of formula in there to think about these issues. There's an SPDA company, or a company selling SPDAs that got caught because they didn't have an internal policy for a credited rate. They were sued and lost the lawsuit because it was not made clear when they were going to take profit and when they weren't, and when they would pass the profit onto the policyholder. It seems unusual, but you have to consider these things. A perspective formula to determine how much money you should keep for future hedges is probably important. The excess would be flowing through profit.

Another issue with crediting rate is the consistency between the renewal participation rate and the current rates on new business. It has not been that big an issue because it's getting more and more expensive to buy options. Essentially, the newer policies should be getting lower participation rates than the older one; however, this may be reversed, and you need to think about these issues. You could use cross-subsidization. People do that on the SPDA side. I think it's easier to do if you have a portfolio hedging strategy and you're not doing investment generation method ("buckets"). Or you can just do nothing and deal with your agency force.

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In terms of managing economic volatility, I just wanted to review different accounting methods that you have to deal with, and start with statutory. Obviously, there's Guideline ZZZ, and the three methods that you can use: the enhanced discounted intrinsic value method, the market value reserve method, or the Commissioners Annuity Reserve Valuation Method-Updated Market Value (CARVM-UMV) method. The main thing I want to say is you have to test those methods for your particular product. If you don't try these methods to see what they do to your product on an ongoing basis, you might pick the wrong one and have to change halfway through, which the regulators never like.

If you want to use the enhanced discounted intrinsic value method, you have to comply with the hedged as required criteria. If you don't comply with the hedged as required criteria, you can use CARVM with UMV. That's probably the most powerful and best method. The only thing that's not really well-addressed is how you deal with lapse and lapse assumptions. By using Guideline 33, you need to take some of these things into consideration.

In CARVM with UMV, you calculate your option embedded in the policy using the Black-Scholes formula and the current market assumptions. You project the index at the valuation rate and calculate future values of the option at each given time. Then you project the future of guaranteed benefit and add the two together. You then run a CARVM with Guideline 33 on these values.

In the market value reserve method, you essentially look at this strike price of the option, the current market value of your option. You accumulate at the valuation rate, and that gives you, essentially, an implied index at the end of the term. You calculate an implied growth rate based on that. Then you project the intermediate values. Again, you run CARVM with Guideline 33 on it.

In the enhanced discounted intrinsic value method, you have a fixed component and an equity component. The fixed component is essentially your guaranteed value in most cases. The equity component is the discounted intrinsic value (it is sort of a book value of the option side). On the

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asset side, you can hold the assets—the options at the sum of the discounted, intrinsic amortized cost. Some companies are using slight fluctuations on that. I've seen the greater of these two values being used.

What's most important is to choose the right method for your product. The CARVM with UMV seems to work best.

On U.S. GAAP you amortize your deferred acquisition cost as profit emerges. I'm suggesting that you use slightly conservative assumptions to avoid declaring a lot of profit up-front and be caught with losses down the road. The options are held at market unless you have hedge accounting. I think a lot of companies do comply to hedge account. You have to have a high correlation between the item being hedged and reduced company transaction risk. If you buy an OTC option, I think you comply with that.

FAS 133 came out, and it has been discussed at other sessions for this symposium. It's going to be effective January 1, 2000, and it introduced the concept of fair value hedge. You, essentially, have to fair value the hedge in the embedded option in your product and match that with your option side. Then, you do the guarantee portion according to *FAS 97*. I think it smooths your income statement quite a bit, because both sides should be moving at the same time. The problems you are going to have are due to large fluctuations on your balance sheet. If you don't want to deal with that, you can always reinsure the hedge portion of your block. Many companies are doing that.

I want to spend a few minutes on Canadian GAAP, just to give a different perspective on these products and how to manage them. We are using a scenario testing approach. We run many scenarios and we model both the stock market and interest rate. We have some correlation in there.

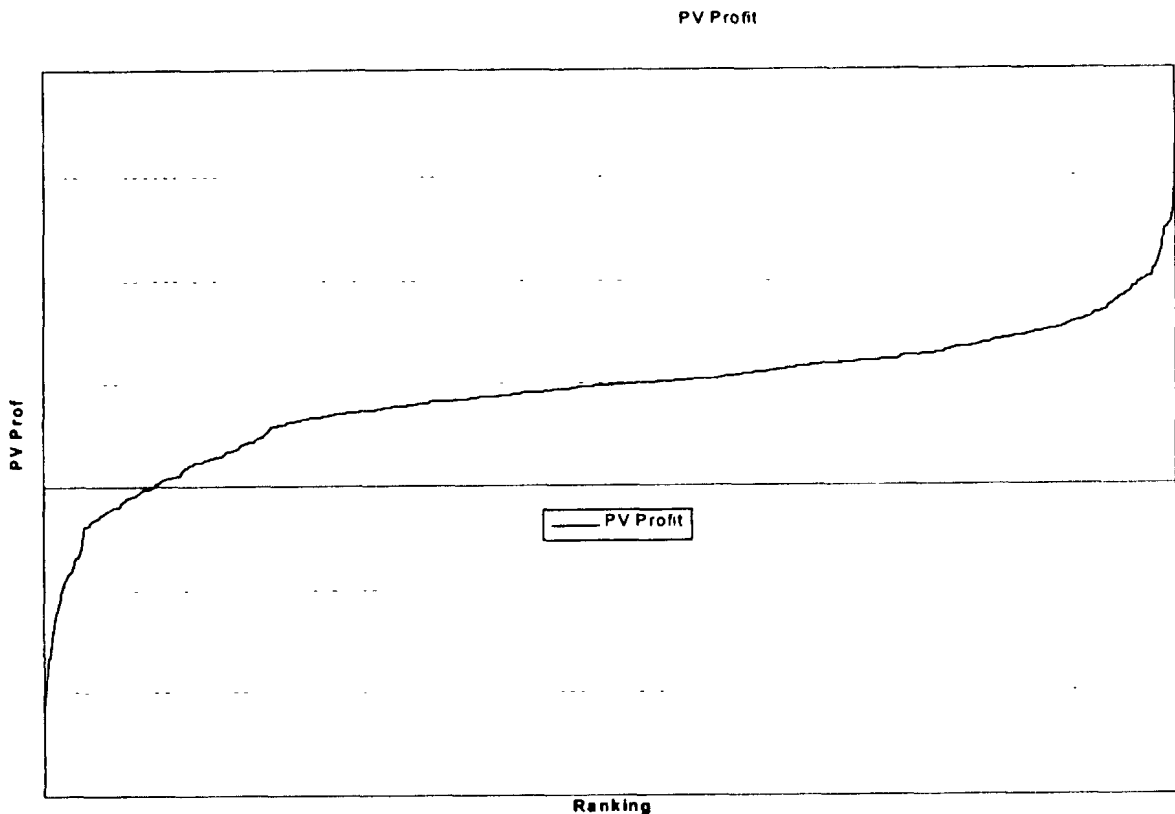
We have two sets of lapse rates. We're using just the base lapse or fixed assumption. We have another one that sort of increases or decreases the base lapse, depending on whether you option in the money and what the stock market does.

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We're also modeling our hedging strategy. You have to be realistic when you do that here. We're trying to have slightly conservative assumptions for the stock market average return, volatility and interest rate fluctuations.

We look at our results, and we feel that, on an economic basis, 90% to 95% of our scenarios are positive. When you look at the tail, it's not horrible. You set your reserve equal to the current assets you're holding. Chart 1 shows one of the products that we reinsure, and essentially, it just ranks the projections that we run over different economic scenarios. There are some negative scenarios, and the rest of them are positive. There is also the present value of profits. In this instance, we wouldn't change our reserve. We would just keep the reserve equal to the assets we're holding.

CHART 1
Canadian GAAP



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If you're using an option replication strategy you obviously have to account for human errors and make sure you stick to your strategy. You might want to move your 90% to 95% or 96% to account for that. If you don't meet your target, which could be 90%, then you basically have to increase your assets and run again until you do. That essentially means you have to increase your reserve at the same time.

For profit declaration, we use the same principle, except that we project the profit that we're going to take out on an ongoing basis on the block. You obviously don't want a 90% confidence ratio, but 60–70% would be slightly conservative. That's essentially what we do. You project the same scenario using your current profit declaration methodology. You want to make the present value of profit be positive at least 50% of the time. It's not formula-based; it's easier to manage earnings that way. The fair value concept in the United States helps us to get closer and closer to this.

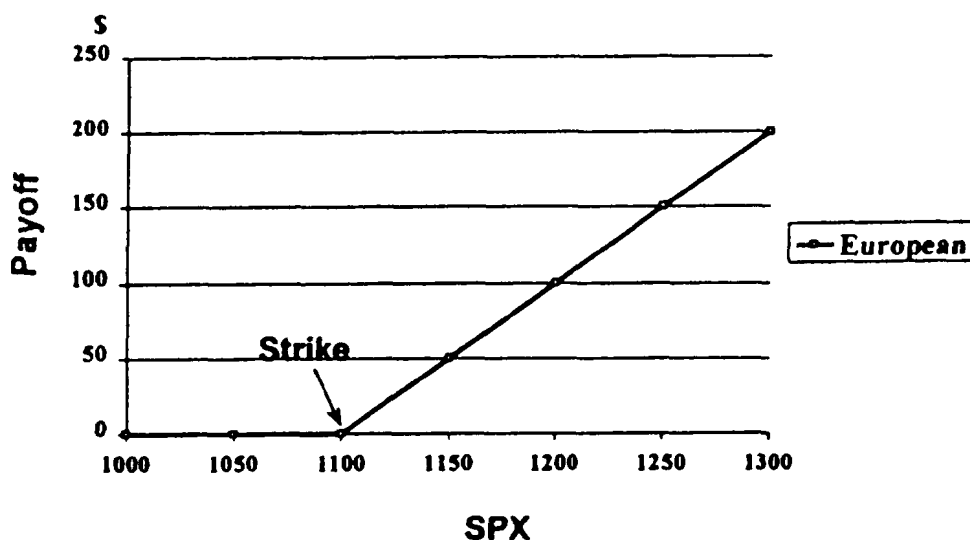
MR. CRAIG FOWLER: Jeff gave us a good overview of product design issues and index crediting strategies and how important that is as you go up through the five-year or seven-year term on this product. He also gave us some insight into how you can better manage your earnings volatility. I'm going to cover a little bit about product design. I'm going to cover more of the investment risks and the hedging issues. Finally I'm going to speak about internal controls and risk management for companies that haven't been active in the derivatives market and what that might mean when you start getting into these products that may be your first foray into derivatives.

In an SPDA type product, you're putting all of your money into fixed-income instruments, and trying to hedge it. With an equity-indexed annuity product, you're putting roughly 80% to 85% of your money into fixed-income. The remainder is going to be the equity option. It's important to keep that 85% that is going into fixed-income in the front of your mind. It is a very material risk on these products.

Let's go over a couple of quick examples of some products that are out there. There's the point-to-point or European, using an S&P index with seven-year term. You're probably paying the policyholder about a 60% participation rate in the upside of the S&P index. You're also

guaranteeing them 3% interest on 90% of the premium over that seven-year period. Chart 2 is showing the payoff of a European or a point-to-point option. If you're in the money above the strike, you get paid. If you're not, you don't get paid.

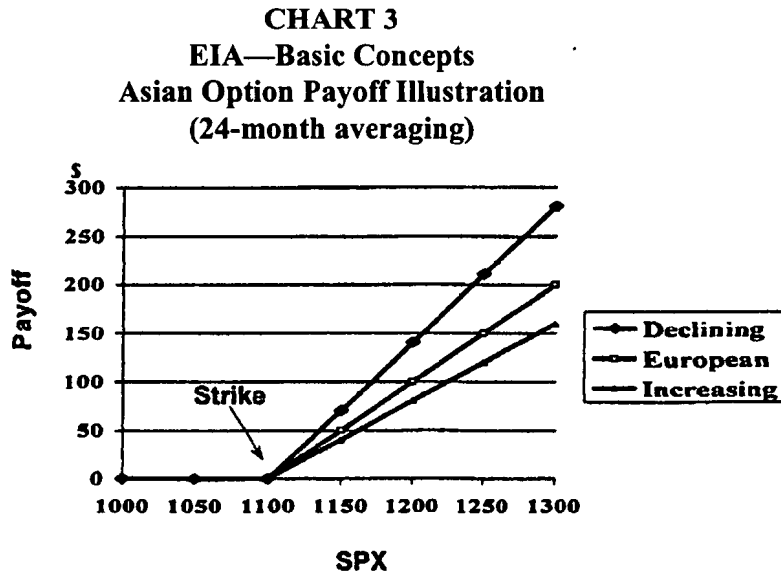
CHART 2
EIA—Basic Concepts
European Option Payoff Illustration



Another product that's out there is more of an averaging or an Asian type option. Jeff said that this is a good product for the consumer. It's easier to understand. It also doesn't put the value of all your interest crediting on a seven-year period at one point in time. You can average it out over a year or two, or even longer. Again, there is a similar index and average over each month over the final two years of the products. It allows you a higher participation rate, which will look good to the consumer if they think they're getting more of the equity index. But, as Jeff said, if it goes straight up, you're averaging over a five-year period. You're really getting only two-and-a-half years of upside. That is something to keep in mind as you're designing these products. You can get a higher participation rate with the averaging. There are the same guarantees on the interest rate side.

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Chart 3 shows what your payoff would look like if the market were the top line. The market declines near the end. You're getting a bit better payoff because you're averaging the part that diminished. The bottom line shows what happens if the market is increasing near the end. That's not going to payoff quite as well as a European or point-to-point option.



We'll get into a specific product example and try to talk about what the different drivers of the profitability for your company would be. Let's assume that we're using a CARVM-UMV reserving methodology, setting aside 5% of statutory reserves for surplus, and discounting the profit at a 10% rate. Let's also assume that lapses are 2% a year. There are no dynamic assumptions on lapses at this point. This illustrates the concept of what's in these products. We are using a standard mortality table and paying 5% commission up-front.

On a point-to-point or seven-year European type option, we're going to buy 87% of the initial premium to allow for lapses. It's just a few percentage points a year over seven years. We're also going to lower how much we're buying in options to reflect the participation rate. The final piece of pricing out the option is where do you want the payoff to be? In this case, we have a strike price of 118% of the original S&P index. That's just to reflect the fact that up to that point, you're paying the fixed-income guarantee. You need to buy options that are out of the money to hedge this risk.

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We have \$1,000 of premium in the door for the point-to-point option. The opening reserve is \$914, and the required surplus is \$46 or 5%. We're then going to spend about \$130 on options and invest the remaining \$830 in a seven-year corporate bond to hedge all of this.

Rate of return on the distributable earnings is 16%. The present value of all your future profits equals \$11. I'll come back to that \$11 to show what different effects all the pieces of these products can have on that \$11. You can ignore the other numbers; \$11 is the key.

When we're looking at the bonds we're buying, the price is going to depend on the yields in the market and the corporate bond spreads. It is fairly straightforward. When looking at the duration of the bonds you need to buy, you'll see that an interest rate drop of ten basis points would wipe out about half of your profit that you have on this product. That's something very important to keep in mind as you're hedging these things. There is still a large risk on the fixed-income side, and the chance of having a ten-basis-point movement over a day has a probability of 15%. So that's one of the risks you need to consider. You've got a large risk to the interest rates when you're selling this product. I think people have been focusing a lot on the volatility of the S&P and the price of the options, and that's a very important piece as well. But, we need to make sure we don't lose track of the fixed-income risk. Credit spreads can move around as well, but probably not as much as the underlying interest rates.

How are we going to hedge the equity risk? You can call somebody up at a particular dealer and get pricing on an OTC option. You can call somebody up at a reinsurer and get a quote on what they might charge you to hedge the equity risk. They need to be willing to take on lapsation and other risks, which may be worth your while to look into. Or you can try to do it yourself as far as some of the delta hedging and option replication, which I'll get into a little bit later. You can try to do that and you might be successful. It may end up costing you more money than just buying the options outright.

There are pieces that go into pricing an equity option. There is the level of the S&P; the discount rate of the swap rate, the current dividends on the S&P (because it is paying off the price index on

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the S&P), the amount of time of the term until expiration, and the strike price of the hedge. This example was 118%, so that cheapens up the price of the option because it's out of the money a bit. One of the very big drivers is the volatility of the equity index and how much volatility is being priced into your OTC options.

Let's just walk through the example that I had set up before using an interest rate of 5.8%. Rates have dropped 35 to 40 basis points, so that would have to be reflected in the option price. The dividend assumption has changed a bit, too. The market has moved around so much that it's about 1.5% now. The strike price is \$118. The volatility of the equity index is 21% on a seven-year. Now it's probably more like 25% or 26%. That has been a material change in the pricing of these options. Your participation rate is 60%. We end up with the option price of \$130 ($\$250 \times 0.6 \times 0.87$) that we're spending to hedge the equity risk on this product.

Let's try to convey what the different pieces are within the equity options that can drive how expensive or how cheap these options are. The option terminology is "the Greeks" and there are many of them. I'll walk you through all of them. I'll try to compare them to things that are more common knowledge within the fixed-income market.

The first one is the delta, which is the change in the option price based on a small change in the stock market or a small change in the interest rates. It is the exact same concept as duration in the bond world. The next one is the gamma risk, which is sort of a second derivative. It's a change in delta based on the change in the market. It's the same as convexity in the bond market. It's important to keep in mind that we're trading options here, so the convexity effect is quite large on the pricing.

Vega is a new concept if you're just used to looking at the fixed-income markets. That's the percentage change in the option price based on volatility, which was 21%. That's a very material part to the equity option pricing. Some of the people who have been offering this product over the past few years have probably become very familiar with this by now. It hasn't worked very well for them since it has been increasing over the past few years.

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Theta is sort of a time value concept. How much would a price change be, based on a one-day change in time? Rho is based on the fact that there's an interest rate piece that goes into the equity option pricing, so how much will the option price change if interest rates change by a small amount?

That's not normal in the option pricing lingo, but what is very important for these products is the "Lhasa Apso" Greek. I made that term up. It's a very relevant risk for these products. I defined it as the risk of getting the lapse assumption wrong. It can hurt you if you're too high or too low, and it is similar to the SPDAs. The thing to keep in mind is that if you're too high in your lapse assumptions, and if you think a lot of people will lapse, but then no one lapses and the market rallies, it means you haven't bought enough options to hedge yourself. On the flip side, if you set a 2% lapse rate and 5% of the people lapse and the equity market drops a lot, you're going to have to sell options that are not going to be worth very much. At the same time, you're also going to have a fair bit of fixed-income risk because you're going to have to sell those fixed-income bonds you bought. If the stock market has gone down, odds are that the interest rates have gone up and you're going to get a double hit there. It's a very important piece of all of this. You need to understand how much tolerance you have for this, and what you can do to possibly control it. As Jeff pointed out in his presentation, there are ways to control the amount of losses you're getting.

There a bunch of numbers on the original concept of the Greeks. I'm not going to get into a lot of detail on these. If the market goes from 100.0 to 100.1 (up ten basis points) my original option that was going to cost me \$130 is going to go to \$130.35. That's the concept of delta. It's 0.035 delta on the whole portfolio. But if you just looked at the option you bought, it's a higher delta because the price or the amount of money that I'm spending on options has decreased because of the participation rate and my lapse assumptions. That's sort of the general idea of delta.

Gamma is the convexity piece. If the market goes up a little bit more (say to 100.2), then you would expect the option price to go from \$130.35 to \$130.71. That's similar to the convexity on a bond.

I'm going to talk about Vega a little bit more because it is fairly material. We had the input of volatility on the option price of 21%. If you increase that 1%, the price goes from \$130 to \$134.30,

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which is a fairly large change in your option price. If we go back to the original example, it's almost half of your profit on the original \$11. The volatility over the past month or so has probably gone up 4% or 5%. So, if things haven't been done to change participation rates or other pieces of the equation on these products, odds are that what you're selling now is not nearly as profitable and possibly causing a loss.

Theta is the time value piece, and it is not as material. The Rho is the sensitivity to interest rate changes. If the interest rates do drop a basis point, your option price drops 14 cents. That's the opposite effect of what happens on the fixed-income risk. If interest rates drop, that helps your option pricing, but it hurts your bond portfolio tenfold. There is a bit of a natural offset between these two pieces, but on the fixed-income piece, within this type of product, it's a much larger piece of the overall risk.

I'm not going to get into very much detail on the other piece that's within all of this. There is the correlation between the equity and fixed-income markets. There are things you could probably do to hatch away at the fact that you are selling fixed-income and equity risk to your clients.

Let's move on to the Lhaso Apso risk. I have tried to define this in a way that will show the magnitude of this risk. Let's say you were to have 100% appreciation of the stock market over a seven-year period. Until three months ago, people would have said that would have been too low of an assumption. It will probably go up 200% or 300%. Now 100% probably doesn't look that unrealistic. If that happens, and you're underhedged by 3%, that can have the effect of wiping out most of your profit. Let's compare that to the \$11 of profit at the beginning. Three-quarters of your profit would be wiped out by the incorrect lapse assumption.

On the other hand, if you've overhedged and the market is flat over a seven-year period, being overhedged by 5% could wipe out three-quarters of your profit. The lapse risk is a fairly important one to keep in mind.

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How might you be able to hedge this lapse risk? You can overhedge in a way by buying 100% calls and not building in any lapse risk. Then you can buy some puts as well, to protect yourself if the market goes down and people are lapsing. This is going to be very expensive, and probably drive all the profit out of your products. You could look at buying a compound option, which is an option on an option. If you don't exercise the option, it doesn't cost you as much. Again, there's more cost on it. You could try to reinsure the risk. Obviously, the reinsurer is going to have to get in some sort of margin for these lapses and will be charging you for it. It's not something you can get rid of for free, but you should be trying to manage the lapses as best you can.

When looking at the equity options, there's a fair amount of what the banking lingo calls operation risk. How often are you hedging? If you delay a week on hedging on, say, \$5 million of premium, the stock market could move 3% with a probability of 15% over that time. That would cause you to have to spend more money on your options. The \$130 you were going to spend originally now goes to \$140, and your profit is basically gone on this product.

How do you mitigate some of these things? You can look at buying options more frequently. You might not be able to do that very efficiently because of small size, especially if you're going to the OTC market and buying customized options. You could try to buy shorter dated, up to one-year call options on the Chicago Board and try to replicate the option payoff on a seven-year product.

Another thing you might want to try is delta hedging the risk. That is the first-order derivative. It's the change in the option price based on the change in the underlying stock market. By coming back to just the delta of 0.65, you can buy futures contracts to hedge this risk. If the stock market goes up, the option price will go up \$65,000 and your futures contract would go up \$65,000 as well. It sounds very straightforward, but there are a lot of pieces that we haven't covered off the gamma and the vega type risks.

What could go wrong in all of this? First, you're missing those other pieces. Delta hedging is really a trade-off between trading for every small movement in the stock market versus allowing yourself some more risk and trading over a longer time period. If you're consistently trading all the time, you

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have a lot of transaction costs and you're introducing a lot more volatility into what you're trying to do.

What else could go wrong? The S&P could gap up, say, ten points a few times during the day without someone hedging it. There have been times when the futures price has sort of disconnected from what the actual price would be. It's a rare occurrence. But it's one of those things that you really need to work well. You need the futures market to work well. It may not, and that would be very painful. It happened back in 1987 with the stock market crash.

If you only have one experienced person who is trading these futures, and if they are not around for a couple days, as you've seen, the market can move a tremendous amount. You need to make sure you have that expertise in more than just one person.

Let's take a simple example of a 5% change in the stock market. If you're delta hedging, you'd expect the price to go from \$130 to \$147 on this option. The actual change is \$147.10. The extra dime is due to gamma (convexity). This is not as material on a long-term, seven-year type option. On a shorter date of one-year ratchet products, this 5% move that you're trying to delta hedge could wipe out more than half of that profit for that year.

Why would you bother trying to go over this exercise of delta hedging? The products that are out there in the market are not that straightforward. They are either long-term or they are long-term with a bunch of twists. The option pricing on these things can be very expensive. The bid-ask price, if you have to liquidate these things, can be very expensive. Those are some of the reasons you might look at delta hedging. A specific example is if you've misestimated the lapses, you try to sell a very customized option you bought off some dealer four-and-a-half years ago. The odds are that you're not going to get a very good price for it. You're not going to see that until that time. If you're trying to delta hedge or replicate the options, you're usually doing that with shorter term and more liquid instruments, which should help you in those times.

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The key is to be more than just delta hedged. You want to be covering off the two other material risks, which are the gamma and the vega type risks. This is especially true on the shorter dated products, where that 5% move in the stock market could wipe out half of your profit on a one-year ratchet type product. To sort of reiterate this, an option is a very leveraged play on the market. You need to keep that in mind, and you need to understand that before you start trying to replicate or trade these things yourself.

In summary, regarding the investment management and hedging, you should be trying to do a macro sort of portfolio hedging, looking at the Greeks of the whole liability portfolio and how that is reflected in the asset portfolio you have backing it. You can start to look at the correlation between fixed-income and equities to possibly decrease the cost of your hedging.

So that covers the investment management, risk management and hedging issues on these products. Let's get into the internal controls for derivatives. If you haven't been trading derivatives, these are things to keep in mind for the life insurance companies. There are new risks that are introduced here. You can overcome them. I'm not saying this to scare people off, but just to make sure that they understand that there are credit risks in addition to just going out and simply buying a five-year corporate bond. There's much more of the operational risks concept. I'll get into that a little bit more as we go through. You need to make sure that the people that are dealing with these things are well-trained and well-versed in the underlying fundamentals and economics of these derivatives.

On the credit risk side, you need to have standards as far as who you're going to deal with. You don't want to be dealing with a company that has a BBB rating. I don't think there are any, but if there are, you wouldn't want to be dealing with a derivatives company. There is a fair amount of risk in these things. Some people have had problems and lost a substantial amount of money. You should be looking to get a AA or better credit rating. You can deal with some special purpose vehicles that have been set up that are AAA vehicles, but there's some issue there if things really fell apart. Would the parent of this special purpose vehicle walk away from what they owe?

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When you're marking these portfolios to market, how much exposure are you willing to take for company XYZ? You need to understand how much they owe you or you owe them at any point in time. That's the daily mark to market. To bring that outstanding risk down to different dealers, you can have collateral and recouping limits such that if my risk to this company hits \$10 million, they'll pay me the \$10 million, and I'll restructure the derivatives that I have with them so my exposure is decreased. That's something that is being done much more in the market and it should help everyone that's involved as far as ensuring that huge problems don't happen in the derivatives market.

For the mark-to-market in the credit risk, you need to understand the "what if" economics of a deal for potential exposure. Take an example of a six-month swap and a seven-year equity option. You have to understand that equity option could increase in value tremendously over the period, and you're at risk to that counterparty paying you back. In a six-month interest rate swap, the odds are that the interest rates at the short end won't move around that much. If they did move around that much, you don't have that long of a duration to really hurt you. In a way, it's the longer term value at a risk concept. You need to think about that as you're dealing with different counterparties and make sure you're not loading up with counterparties and a lot of potential exposure down the road. You should have full two-way netting. If they go under, they can't walk from certain contracts or vice versa.

Other ways to mitigate this credit risk are time puts. If you have a seven-year option, you can write into the contract that after three or five years, both parties can look at it and decide if they want to keep going with the derivative contract or if they want to close down the contract and pay the person who is owed the money. That ties in with credit triggers, so that if the counterparty credit rating drops from AA to A, you may have an escape clause on your derivatives contracts such that you don't maintain this exposure to this counterparty. There are many other ways to mitigate these credit risks for your company. It's something that you need to keep in mind. It's a very different credit risk than most life companies have been used to in the past.

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On the operational risk side, you need people who are well versed in derivatives and have a very thorough understanding of the economics of these things. One thing to mitigate this risk a bit is to make sure you keep three, four or five dealers and that you talk to people consistently and get quotes to make sure that the quotes you're getting on new business and existing business are good. You don't want to be put into a position where you're trying to unwind an illiquid option, and you haven't been getting a feel for where the market (meaning a few other dealers) was on that particular instrument. You might be forced to sell it at a huge loss. You're much better to keep that process going. Hopefully you won't need it, but if you do, you might be able to sell a derivative to somebody else. If you bought an equity option from this company, you could sell it back to somebody else. In essence, if you have some outstanding credit risks, you might be able to get a much better price for what you own.

You should have a master International Swap Dealer Association (ISDA) contracts for all counterparties. The ISDA has sort of standardized contracts that you should have put in place with all your counterparties. Make sure you get legal counsel involved in the documents. These are generally written by lawyers. You want to make sure that there's nothing in there that can hurt your company down the road.

You need to make sure that you're segregating duties. If you have people doing too many things, it's easy to lose track of what you're company is actually doing in derivatives. You need to segregate between the front office trading people and the back office people, who are part of your accounting, reporting, and risk management areas.

Within your internal operations, you should have some sort of limits on how much a trader can actually do in derivatives. It can be a notional amount of say, \$10 million or \$50 million of notional swaps or options. On the other hand, if you're dealing mainly in options, you should be looking at the premium in addition to the notional amount. Different risks occur depending on whether you are buying or selling. The traders need to give the investment accounting area very detailed instructions about what they bought to make sure that when the confirmations come through (which should come through within 24 hours) they reflect what the person agreed to over the phone. Whatever you have

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on paper that you sign will end up driving what you're going to get for these options or swaps down the road.

You need to have people signing these derivatives transactions on an ongoing basis, and you need to make sure that there's some independence there. You need to have an accounting or reporting area checking these over and possibly signing these as sort of a final sign-off.

Another piece of this risk is that when you're trading a bond, and most accounting areas are fairly familiar with trading a bond, you might have a three-day settlement where \$25 million goes out three days later. With derivatives, you may not have any cash change hands at all, or maybe a very small amount. You have to understand that there's a lot of leverage in these things and make sure the people who are handling the accounting and reporting understand the economics at inception and at settlement. Periodic payments need to be made and you need to make sure that you have a system and people in place to monitor these and pay the money. What's more important is if you're owed money you need to make sure you're getting paid full at the settlement.

You need some sort of system or reporting methodology to look at the mark to market and track these things. You should be getting weekly position reports by counterparty and by underlying instrument that both your internal investment committee or chief investment officer have and are well aware of.

That sort of wraps up my presentation on equity products. They've been around for a few years. Many people are looking at them now and wondering if they should keep offering them because the economics and the profit may not be so good. There are probably a lot of people out there thinking about getting into them. I think it's something that the consumers will keep asking for, especially with the market dropping. We have to find different and innovative ways to give them that exposure to the equity market, but make sure that we're making a buck on it.

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MR. G. THOMAS MITCHELL: My question is on hedge accounting. We still have a requirement that it reduce the hedge at the enterprise level. You could have a nice, tight, beautifully conceived hedging program to reduce the risk on your equity-indexed products to zero. Do you then have to demonstrate that it reduces risk at the enterprise level?

MR. FOWLER: That's correct

MR. MITCHELL: That sort of documentation is another barrier to hedge accounting. Any comments on the information technology side of putting it together? We talked about what needs to come out of the derivative side and what needs to come out of the policy accounting side and how you marry those two together to see if you're in good shape on a hedge.

MR. FOWLER: I think you've raised a very important issue. The major systems that are out there have probably been built to handle the actual derivatives fairly well. You need to marry the two sides and have a full view of the asset and liability side. I don't think that there's anything out there that actually handles all of those pieces right now. I'm not going to make a plug for our product. I think both the Profit Testing System (PTS) and the Tillinghast Actuarial Software (TAS) have the capabilities in there, but they are not as robust to handle the derivatives. I would think you would see more developments along that way as people introduce and sell more of these products.

MR. HAMBRO: We have a system that will properly track the policy and the derivatives and the fixed-income portion of the assets. If we were using an exact hedging method for our product, that would be fine. We're doing a dynamic hedging program. The problem is the time steps that the system can model. The system will model, at most, monthly. Frankly, there's a large amount of modeling error that occurs as a result of this. We're going to take the basic information from this system and then build another system on top of it that will simulate daily transactions.

MR. POULIN: We have our own system, too. We're using both the option replication approach, and we have some OTC options at the same time. I think you have to have a system like you do on the SPDA side. Many companies have built their own. You could use the TAS or PTS system. I'm

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not aware of any perfect system out there, especially for option replication. It makes it very complicated. I think if you're buying over-the-counter options, you can build your own and have calculations that are properly done and properly modeled on both the asset and the liability side.

MR. HAMBRO: When you're selling this product and you're exact matching, you're buying volatility from Wall Street. If you have a one-year ratchet product and you buy a one-year call spread option, you have cash-flow matching, and you're buying volatility. When you're using futures to replicate options, you're no longer buying volatility—you're actually inserting your view on volatility. You're saying that you have a specific view on volatility and you're going to take the volatility risk. There are ramifications for doing an option replication strategy if you don't have offsetting hedges like minimum death benefit guarantees in variable products and things like that. For example, your company could do a pretty good job for, say, five or six months, and then get hammered in a couple of days. This could wipe out all of the gains that were built up by the effective previous hedging. That's one of the primary differences in the ways to manage the product.

MR. POULIN: Regarding OTC options, you are able to negotiate with the brokerage houses if you have enough volume to get clauses in your contract that will guarantee a certain difference between the bid and ask price. You can get collateral on these products. If you have contracts with many different brokers, you can make those very illiquid options fairly liquid by putting in the right clauses. Again, the bid and ask is a big issue, but you can get them to guarantee that up-front.

