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Session 23 TS
Hedging and Other Mitigation Techniques

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Summary: The session describes current risk mitigation techniques and their impact upon valuation systems. Topics include hedging mechanisms, regulatory relief, anticipating the evolution of GAAP measurement, product "quarantine," realistic assumption changes, and maximizing returns and minimizing litigation.

MR. PHILIP BIELUCH: I've been involved in a process where we've been setting up a guaranteed minimum death benefit (GMDB) reinsure fully hedged. I'll speak more about that later, but in the course of that we did a lot of research on who the active consultants are in this area. I'm very pleased to be sitting here with two of the actuaries I think are the most experienced in this area of hedging. I think you'll see that in their presentations. Later, I'll be giving the presentation from the company perspective. Ken will go first. Then David and I will continue.

MR. KENNETH MUNGAN: I'm an equity principal with Milliman. I'm president of the financial management practice. My group has worked on hedging of variable annuity (VA) guarantees for quite some time. To do that, we've brought together a number of different specialties, such as actuaries, quantitative professionals (primarily with PhDs), software engineers and capital market people. As I go through the presentation, one thing I'll point out over and over again is that in order to bring together all of the components that are needed to understand hedging properly, you do need to have a number of different people. With that, I'll start going through current developments. This is not intended to be an exhaustive overview of hedging, but it will cover some of the key things that we're seeing now.

Note: The charts referred to in the text can be found at the end of the manuscript.

My basic point is that however we got to the right answer, I feel that we've gotten there. Hedging is a core activity of life insurance companies these days. It has been a process over the years of chief financial officers (CFOs), chief actuaries, chief risk officers and, ultimately, CEOs coming to see that, but I think at this point that basic question has been answered. Now the next question is, how do we use hedging most effectively at lowest cost to develop innovative products?

As I said, hedging is now a core activity. One of the ways that we're seeing that actually used within companies is through the major global insurers that are adopting hedging as their basic principle for managing any products with guarantees. I was talking with the chief risk officer of one of these companies last week. He said that they give all of their operating units a lot of freedom. They can offer any equity interest rate guarantee on products that they want, provided that they can demonstrate to the company's satisfaction what the cost of hedging this product is, show that they've built in some margin above the hedging cost, and explain that they are going to follow guidelines of full hedging. Now that's obviously not the strategy for everybody. But clearly for this particular company, with their presence in the market, it makes quite a statement.

Over the years, one of the things that's helped move hedging along as a standard practice in the industry has definitely been plotting for an external constituency. We've definitely seen rating agencies, equity analysts, regulators and auditors come into play at one time or another. One example is that on Sunday I was e-mailed a research report from Salomon. It was about 60 pages on living benefits. They basically said that companies should be hedging. That type of pressure pushes CFOs along to at least understand how hedging is going to fit into their strategy.

Basic products in the market today include death benefits, accumulation benefits, income benefits and withdrawal benefits, in all of their many flavors. It's stunning how successful the withdrawal benefits have been. If we look, there are two characteristics that can help us understand why. When you come up with a product that offers a range of choices to policyholders in terms of investments, gives them flexibility in terms of putting money in and taking money out, and ultimately offers a transparent guarantee that they can understand and that can be explained to them by an advisor in very reasonable period of time, that goes a long way to explaining withdrawal benefits.

As I said several times, hedging is a core activity of life insurance companies. That means it's fundamentally different from asset liability management (ALM) studies that might have been done in the past. When I started my career working on fixed-interest ALM studies, it would be something that we would look at maybe semi-annually; the general conclusion was that we're fine and that we don't need to do anything. Hedging is fundamentally different from that in that we see activities that occur on multiple frequencies at different levels of the organization. For example, you can have a daily process of valuation of the liability, valuation of the assets and preparing a database of market data that can be used to execute trades as the

market moves. From my point of view, I feel that best practices require at least a weekly profit and loss (P&L) for any hedging program with the detailed performance attribution report. It's not enough to simply know what your gain or loss was relative to your expectations for the cost of the hedging program. You need to know what caused that gain or loss. You need to know if that deviation is within the bounds that you set up when you established the hedging program. Then finally, a quarterly or annual review, where you look at the long-term assumptions underlying the program, is needed. These could be actuarial and capital market assumptions.

One of the key activities within any hedging program is fund modeling. If you think of the typical variable annuity writer that could have 50 or 60 funds (we have clients with over 100 funds), it's simply impossible to have, for example, 100 different hedge instruments matching up one-to-one with each fund. Those hedging instruments simply don't exist. That creates a requirement for matching variable annuity subaccounts to broad-based indices. It's not necessarily a one-to-one matching. You might have a single fund mapped to Standard and Poor's (S&P), Russell, NASDAQ and so on. We find that this activity finds many uses within the insurance company, not simply hedging. For example, it will simplify going through the process of manager selection, manager evaluation, determining if managers are actually generating sustainable Alpha and if they are following a consistent investment style. All of that can be gotten from a fund modeling exercise.

Chart 1 shows an example of a particular block of business where we do the fund modeling process and match up funds to broad-based indices, such as U.S. equities, bonds, money markets and international equities. You can see that each fund gets its own weighting. There are different ways to approach this modeling problem. For companies that are hedging, this is probably old hat. I think the greatest advance in fund modeling recently has been the ability to look through the funds to the underlying holdings. It's inevitable with fund modeling that your actual funds will have some degree of noise between the actual and the predicted results using the fund models. Being able to look through to manage your holdings and aggregate those holdings to cross funds gives you another layer of insight into any mismatch that might come up.

This gets applied once the fund modeling procedure is done. Then we can take any specific policy, which might have three or four different funds, and we can map it, using the fund modeling on each of those policies, and then aggregate it up to the policy level. Chart 2 shows some sample policies—high volatility, low volatility and the total block—and their allocations to basic indices. It shows that the underlying risk characteristics of these policies are very different. We have the annual volatility ranging from 9 percent all the way up to about 21 percent. If you were to simply assume that all policies follow the characteristics of the aggregate block, then your hedge positions would be significantly off.

One of the issues that we've had to deal with over and over again is the potential for basis risk. This is the difference between actual fund return and the model fund

returns that are made by combining the different indices. The key outcome of this is that the variation that you see on the typical variable annuity subaccount, where we actually have significant amounts of money invested, is very small from one month to the next. It may be positive one month and negative another month. Over the periods of time that a life insurance company would be concerned with, like a year or so, basis risk tends to not be that significant.

One of the other things that we've looked at is how the variable annuity market has changed over time. We have seen some important changes. In Chart 3, we've collected data on policyholders and looked at the aggregate portfolio volatility of the funds that they select, at the point where they enter the VA market. You can see that policyholders that invested in the late 1990s were basically constant with their asset allocations. About 63 percent were in stocks and the rest spread between bonds and money markets. That created an aggregate portfolio volatility of about 13 percent. Then as we went through the bear market, we saw that volatility drop down about four percentage points, as people moved roughly 20 percent of their money out of stocks and into bond money markets and fixed accounts. As the markets come back we've seen a bit more going into stock, but it definitely has not bounced back to the mid-1990s level. Then, probably more importantly, in the bottom table you can see that policyholder behavior varies significantly by age. Older clients are more conservative and more interested in guarantees.

Fundamentally, I view insurance contracts with guarantees as long-term options. For example, any kind of variable annuity guarantee can be viewed as a put option on the basket of index funds. These put options are complex in nature, so it's not possible to write down a simple closed-form formula. But the basic principles of option pricing theory apply to variable annuity guarantees. Some of the key differences between these VA options and the options that we see traded in by investment banks would be that they are completely liquid. That does change the equation a bit in that if you're a trader in the over-the-counter (OTC) market, you can close out your positions and sell them for cash. But if you own a variable annuity with a guarantee and we have significant market decline, then in order to get cash you have to hold on to that contract and follow the contractual requirements of the VA guarantee. That changes the hedging paradigm a bit. The good news is that it works in the favor of the life insurance company.

At this point, I'd say the industry standard approach to variable annuity guaranteed hedging is mapping first-order partial derivatives of the market value of the variable annuity guarantee. You have to map out Delta, Gamma, Rho, Vega and so on. If you're just Delta hedging, then you are hedging your exposure to directional movements in the equity market. When you add in Gamma hedging, that's a second-order derivative, you're using a combination of futures and options, so you have a tighter fit. Once you go into Rho hedging, that's hedging your exposure to interest rates. We'll go through some specific examples of that. Vega is your exposure to implied volatility. There are a number of companies in the market that have gotten very comfortable with this approach. Over the next year or so we're

going to see next-generation hedging strategies that aim to do an even better job than these types of approaches.

One other point in terms of this greek-based hedging is that when you're using multiple instruments, of course, you need to balance out in residual greeks or residual market sensitivities created by those instruments themselves. For example, you start by hedging Gamma and then you buy short-term put options. That creates its own Delta. If you're hedging Vega with a longer-term put option, that's going to create its own Delta, Gamma and so on. So the typical approach is to do these step-wise, so that your portfolio in total liabilities, plus all of your heavy assets, is marked mutual.

The first thing that we always get from a CFO is that it sounds great, but what does it cost? There are really two phases to that. One is to determine the expected cost of the hedging program. For that we go through and as actuaries make a whole host of assumptions on age distributions, fund volatilities, capital market parameters and so on. Then in a fairly straightforward way you come up with the expected hedging cost. The second phase is much more complicated. Once we determine that a moderately aggressive portfolio of annual ratchet GMDBs with that mix of age distributions would cost 23 basis points to hedge, we have to figure out what the potential range is. Is it 20 to 26, or is it 10 to 55? That is a much more complex question to answer that requires very sophisticated financial projections that actually illustrate all of the transactions carried out underlying the hedge program. There is no perfect hedge. You simply won't be able to find one. If you go to an investment bank and demand one, they will give you a quote that's so high to take on all of those residual risks that it, by itself, becomes an imperfect hedge. It has destroyed the economics of the variable annuity product. You're going to have to make some difficult choices. Do we do everything ourselves with a fairly limited hedge? What products do we buy from the investment bank? Do we build the capability of using these products in combinations to try and create a more efficient hedge at lower cost? There are a lot of choices to be made. It's not so simple and straightforward as simply calculating these numbers and saying that that's the end of it.

Chart 4 shows some basic costs of hedging GMIBs. The key point with GMIBs is that they are a dual exposure, not only to the equity market (the S&P, the Russell and NASDAQ), but also to interest rates. Interest rates are significant risk factors for GMIBs.

Chart 5 shows some basic hedge costs of guaranteed minimum withdrawal benefits (GMWBs). With GMWBs you can do the same calculation. One of the key points to know is that GMWBs are very sensitive to the underlying asset allocations. I think that's why a number of companies move to having asset-allocation programs as a requirement to purchasing a GMWB. You can see on the chart that if we have everything in the S&P 500, we're showing a hedge cost of 89 basis points. If we had everything in the NASDAQ, we might have a hedge cost of 150 or 200 basis points.

So given that, allocations like moderately aggressives, which have a reasonable blend of equities and fixed income, are definitely favorable in terms of managing a hedging program.

There's a whole host of modeling issues. One of the most important is the policyholder behavior. There are a couple of key points on that for the GMIBs. It's critical to come up with an annuitization assumption that's realistic. You could simply assume that no one is ever going to annuitize and have the problem solved and we can all go home. But if it turns out that people actually do annuitize, then you might be in deep trouble, so it's important to come up with an assumption that's reasonable. It shouldn't be excessively conservative, but it also shouldn't expose you to too much assumption risk. Clients generally tend to go a little bit more on the conservative side on things like the annuitization election rate.

Chart 6 shows basic hedge costs of GMWBs by cohort. The key point is that it would be inappropriate to make an aggregate-withdrawal assumption. Having the approach that all policyholders follow the same withdrawal pattern is going to lead you down the wrong road. Our general approach would be to use what we call a cohort method. With this method we set up withdrawal behavior patterns as a new dimension of the modeling problem. Here we have five different cohorts. Some people start taking 4 percent withdrawals immediately; some wait three years and then take 7 percent; some wait five years and then take 7 percent; some take dynamic withdrawals, which generally range from 2 percent up to 7 percent as the benefit goes into money; and some people may take no withdrawals. The typical approach for GMWB modeling would be to come up with cohorts and then to assign probabilities to each of these cohorts. Then you need to set up a process for monitoring the data as it actually comes in so that those probabilities can be refined over time. The key, from the senior management point of view, is that in none of these cells do we see hedge costs of 200 or 300 basis points. Clearly there's a variation, but we have even the most extreme cohorts come in slightly under or at what you're charging in the marketplace. That gives people a lot of comfort. I can virtually guarantee that whatever probability you assign to these cells, you'd be wrong. The goal is to not be so wrong that you're unemployed. I think that's a reasonable approach given the numbers that we're finding here.

I have another note on dynamic lapses, and just policyholder behavior in general. I often find people extraordinarily focused on the performance of these hedging programs, and of the products, in a down market. It's obvious that everybody is wondering what's going to happen if the market goes down. They want to know how effective the hedge program will be. They also want to know how far off we might be in our assumptions. Sometimes it astonishes me that people don't look at what happens if the market goes up, because we're very likely to see a healthy, robust, growing stock market. If you make assumptions that look fine in a down market from the actuarial side, you don't want to put yourself in a position where the market goes up and your hedge program immediately generates large capital losses. Then everyone lapses your policy and you have no future revenue stream

with which to be repay those losses. It's critical to do sensitivity testing of all the key assumptions for both bad and good market scenarios.

Chart 7 is an example of key rate Rho. I touched on it before. We talked about Rho hedging, the idea of hedging your exposure to interest rates. For GMWBs this is critical. They are very sensitive to interest rates. But what's probably as important is that it would be inappropriate to assume that the interest yield curve is simply going to move in parallel. It's not. The sensitivity of GMWB varies a lot by the point on the yield curve. The general approach is to come up with key rate buckets that are matched to your hedges.

Chart 8 lays forth an example of dynamic hedging on a block of GMWBs. Here we're following a Delta-Vega-Rho strategy using futures, options and swaps. In the model we're doing a stochastic valuation of the entire book of liabilities once a week. Then we automatically rebalance our futures positions each week. Then we trade options and swap, subject to trading rules that take into account the value of risk created by a mismatch and by the transaction cost associated with these instruments. A model that ignores transaction costs is going to give optimistic results. It's important to have those in there.

Chart 9 shows the volatility of quarterly GAAP earnings of the GMWB on a hedge basis. I think this is a $1 million contract. You can see that this is just too volatile. As we go through and look at what this would do to somebody's financial statement if they sold large amounts of GMWBs on a hedge basis, we see that it would simply be devastating.

Chart 10 follows this algorithm that I talked about for hedging using futures, options and swaps maintaining the scale. You can see we're simply at a different order of magnitude. To put this into appropriate context, the last point I want to make is that this assumes that policyholder behavior follows the company's assumptions. The next step in this is to assume we're going to be doing dynamic hedging and also recognize that there may be some variations in policyholder behavior. Then you'd have one set of behavioral assumptions in your mark-to-market and in establishing your hedge positions, and another set of behavioral assumptions that have actually been experienced in reality. This distribution would widen out a bit; the goal is to avoid widening it out so much that you're no longer interested in the product. That has been the basic conclusion of the senior management groups with which we've worked.

You can regard the financial risk that's created by variable annuity guarantees in several different dimensions. One that's very acceptable and manageable is the market risk of both equities and interest rates, and then the behavioral risk. Insurance companies and actuaries are very experienced in dealing with that type of risk. You can deal with it separately and then combine it together to have a final view of what this product really looks like on a hedge basis.

Policyholders and the customer base of life insurance companies live in a very complex world. Clearly we do as well. Insurance professionals should step up to the plate and help create products and overlay technology and financial risk management techniques to shield policyholders from that complexity. They should also offer them promise that preserves their choices and their guarantees. If we can do that, then I feel this life insurance industry is going to advance and ultimately gain market share from other market participants with which we historically competed. We're just getting started. The variable annuity guarantees are probably the first best examples of this.

MR. Hopewell: When you show the change in allocation between equities and bonds over the period from 1995 to 2003, how much of that was because of active re-allocation by policyholders versus how much of it was the dropping value of equities relative to bonds?

MR. MUNGAN: It was 100 percent through active re-allocation. That is because we're looking at policyholders when they come into the population. We weren't tracking people as they stayed in the population.

MR. BIELUCH: So those were new-money allocations.

What I'm going to talk to you about is some of the work and some of the thinking that we've had in actually setting up the company for hedging. I'm going to start with a review of what companies have actually been disclosing in this area. Certainly Form 10-Qs have become a source of competitive information and have helped actuaries in understanding what sort of a matrix should be in these areas. Unfortunately, many of the market participants are foreign companies, and it's harder to find the information on them. For a few foreign companies you can actually find some information on the Internet. For example, one of the foreign companies is AXA. They have some information and quarterly earning slides if you go to the AXA corporate Web site. I'll talk about that further in a minute.

As Ken mentioned, this area is under focus by the financial analyst community. I think this year you'll find greater disclosure among the U.S. companies. There are a lot of major companies that demutualize. It's such a small piece and it's not significant, so they haven't disclosed much. I suspect you'll see more if the analysts start looking for it. I also think that there's a trend among auditors to look at the notes in somebody else's Form 10-K or 10-Q and ask, "Why shouldn't they be in yours?" I'm highlighting these, and you'll see some interesting disclosures.

Chart 11 is CIGNA's 10-Q. For those of you who have responsibility in this area, I think you'll find the 10-Qs today are what the 10-Ks used to look like three or four years ago. It's just gotten that much disclosure. CIGNA is an example of high-quality disclosures. It has given a lot of information to the financial community, certainly for the reinsurance book of business. This information is from the 10-Q at the end of June 2004. The fair value of the mutual funds underlying the book is $47

billion. Their death benefit coverage in force is about $11 billion. They have about $1.1 billion of future policy benefit reserves for GMDB. The notional amount of the futures and forward contracts were approximately $1.7 billion.

But what I want to focus on more is what the experience has been just from looking at these futures and forward contracts. You'll see what they have if they've actually lost money. But that should be expected in a surviving or static market. The liability, if it's a hedging program, should go down by the same amount. If you study the results, I think you'll find that the earnings haven't changed by much, but they actually have had asset losses to that degree.

Another company that has some disclosures in the 10-Q is Lincoln, which you can see in Chart 12. They have some disclaimers and it's a bit more legalistic. Fewer hard numbers are disclosed. One of the issues you're going to have to deal with in doing your notes is what flavor of disclosure you do. Lincoln is sort of forward-looking by saying they'll hedge more of these depending upon what happens to the market, and they'll always consider other things that they might be able to do. As I said, this is from the 10-K. The information I've presented here is only a subset; nothing I say should replace reading the entire 10-Q for understanding their hedging program.

I also want to point out that a company may actually go so far in their quarterly earnings informationas to define hedging costs for different numerical levels of volatility. You might find that interesting if you're trying to get ballparks on hedging or determine if the hedging costs that you develop are correct or in line with others.

I am going to talk here for a minute about company organization. Typically, companies have a reporting structure where one side of the house talks about assets and one side of the house is responsible for the liability. If you hedge the variable annuity guarantees, what side of the reporting relationship does the responsibility fall on? Does the asset side of the house have the ability to understand these tools? Will the asset side of the house be comfortable with the swings in performance based upon market movement or non-movement? How do you work that through your management reporting or, more importantly, through your performance-based compensation system within the company? Do you take those earnings, plus or minus, out of the asset side of the house and put it on the liability? Do you look at net? That's something that you're going to have to deal with in setting up these programs and then actually running them going forward.

Does your asset side of the house have the risk-taking culture in order to compete effectively in this market? Certainly a lot of the options market got their feet wet in 1987. October 1987 was a defining moment in which some of the option market makers went out of business, and others made an awful lot in that huge market swing. Those that made a lot took a lot of risk in order to make that, because no one foresaw such a big drop in the market.

This is also why I feel that insurance companies typically haven't done well in the real estate market. They're competing with a bunch of people with the longevity and the authority to make companies go bankrupt and re-form the next day. Look at some of the real estate moguls in America and look at how many times they've gone bankrupt in their career. The real estate investment side of an insurance company typically doesn't have that longevity to do that.

The other thing in a reporting structure is that when you actually set up a hedging, it will create turf wars within your organization. It's sort of like the turf wars that got created when asset liability got the management set up. Is it an actuarial function or an investment management function?

It's my understanding that a number of companies have looked at and some have implemented Delta hedging. I want to remind companies of the risk if the market is in a free fall. In October 1987, Delta hedging was called "portfolio insurance." The principles behind Delta hedging, or portfolio insurance, require that if the market goes down, you need more hedge. Unfortunately, these hedges may not be available when you look to buy them. What happened at that time was that they weren't available, so the market went down further and further until people found accommodative pricing for the hedges.

If you were in a Delta hedging strategy and the market went down 30 percent during the day-to-day, what sort of positions and how frequently would you expect the traders to rebalance? Would you expect them to rebalance? Or would you counter that with the idea that these are long-term liabilities and it's a temporary blip? Even post-September 11, it was only a week or so before the market got back to normal. How would you trade in that market? More importantly, how would you plan on trading and what are the company governance rules in that area?

For those who have gone beyond some sort of option-based program, there's less requirement typically to go into the market in days of high stress. Your options tend to react better. Matching Delta is like matching duration. It's an overall number when you match duration on interest rate. Unfortunately, there's no analogy to cash-flow matching on interest rates. There's nothing in the science that says, "Here's exactly how we'll match it." But option-based hedging certainly gets you a lot closer to where you need to be.

With an option-based strategy, just like in duration matching, you can get to a Gamma. If Gamma on a billion-dollar block is $45 million, you can get there by one-year option or 10-year option. There's nothing in the pure Gamma number, just like there's nothing in duration, that tells you exactly what instruments you want to buy. So how do you decide within a company organization what options you're going to end up with? Should you allow your trader to take positional bets? Right now, volatility is at a relative low. Should you go long on volatility? What sort of corporate governance are you going to have around? What can the trader do to

match Gamma and what can't he or she do to match it? Again, remember we were all within this environment of, how do you pay for performance?

Also, another area here is this issue of longer-dated options that are only available on over the counter. You're not going to have an empirical formula that says how much that option is going to cost you. You're going to have to go out to the market on a given day when you look to buy and you're going to have to see what they would charge you. You're going to have to go to different investment banks. There are some investment banks right now that think volatility is going to go up beyond five years. Some think it's going to go down. Certainly volatility is the key assumption within these option prices.

It's easy to say you have a model. Actually validating what that model is going to produce for hedging cost and option prices is not so easy. It has to be validated almost continually, and you may be wrong. It's even harder defining what these options will cost in the future, based upon the scenario.

Now I'm going to talk about financial reporting issues. How do you develop the fair market value of these options if you do go options? Where do you get your assumptions? How do you make sure they are auditable? We're dealing in the over-the-counter options; we're not dealing with a volatility-type of assumption. Do you take your book of options and go back and try to get a market value on them if they are over the counter? Who gives it to you?

Another area is appropriate volatility assumptions. Make sure you understand the difference between historical volatility, which is a volatility people have actually seen, versus historical implied volatility, which is the history of what market makers have actually charged for the volatility. For instance, implied volatility is what they are charging today. These things have different values and different graphs. Recognize in dealing with these assumptions that you need to understand when you look at a historical table which types of volatility you're talking about. Then there's the other one called "real world," as opposed to risk neutral. With volatilities, be specific on them. Another problem comes up in that there's an option on volatility—the SPX. That's a very short-term volatility. But these historical volatilities for implied volatilities are only kept at the investment bank. Let's say you wanted to do a 10-year option, which is available over the counter. There's no published pricing benchmark on how those were priced over the last five years. Certainly the investment banker would know, or the banker selling the options would know, how they priced it. But there's no published index. So when you're trying to do the modeling going forward, it's one thing to say aggressive or conservative, but when you try to validate it to actual experience you're going to have a hard time finding metrics.

What sort of deductions should you take in valuing the options for credit risk? Certainly if you're dealing with trader options they're guaranteed by the Chicago Board of Options Exchange (CBOE), but what about other counter-parties,

especially if you're going out to the over-the-counter? One other comment I have on the financial reporting issues is to start working on your financial statement footnotes now. You don't want to be there in January worrying about what information you need for your financial statement. Start doing your surveys of what people have reported, what questions you've gotten in your quarterly conference calls and just what you think you should be reporting. Get the data together, or else you'll be scrambling for them at year-end.

When implementing a hedging strategy in a company, obviously both sides of the company need to be involved. You also have to decide what strategy you are going to follow. What are you going to hedge? Ken spoke a little about hedging Vega. Under what sort of scenarios do you want to cover yourself? What's the purpose of hedging overall? Is it to reduce the loss scenarios so that we make a gain in most of our scenarios? Certainly that helps from a capital point of view. Or, do we reduce the standard deviation of expected value? It brings you to two different answers on hedging. I think the capital market folks are more comfortable with reducing standard deviation. If you're looking at justifying the hedging program cost by capital reductions under C3 Phase II, you might be in the loss scenario. Another goal to think through with whoever is doing the hedging is, should you hedge revenue separate from claims? There are different characteristics from hedging in an up-and-down market as opposed to the different characteristics of the revenue in an up-and-down market versus let's say some sort of maximum account value death benefit. Those two will react differently in stochastic scenarios. Should you be hedging them the net amount or should you be hedging them separately?

Finally, your management structure needs to understand the variation and likely swings in asset values. You could lose $250 million in a quarter if you have a large enough block. But it's also hedged economically, so your liability went down. They need to understand when they see that big number that it's actually a probability. Frankly, when you do the estimates of the following quarter or the following year, you should probably discuss what the worth of your hedges is going to be in these alternate scenarios going forward.

With regard to systems, I've yet to find an out-of-the-box system that will help you get anywhere near some of the hedging values you can write on your own machine. Also, there's a lot of vaporware on the market. I don't know if you're familiar with the term, but vaporware is software that systems vendors sell that doesn't exist. They've now started calling them consulting assignments to do something. But certainly you'll see when you buy these systems that they always come with the consulting assignment to make it work for what you need.

It's very hard to model the trading strategies and transaction costs. There are rules of thumb that people will make for transaction costs. One of the problems is that if you're in a Delta strategy or rely somewhat on futures, sometimes the market shuts down. It shut down on September 17. If you're running with monthly granularity, if

your system can only handle monthly results, how do you model that? Do you assume the futures market is shut down for a month?

Ken sort of spoke to a weekly sort of model in what he did. I think certain systems go down today if they are totally focused on that. But then you have the issue of runtime. What's the system going to do? Is it going to do 252 cycles a year or 12? You need some ability to get some real-time options. Ken talked about needing an attribution analysis system. Remember, a lot of these modeling systems you hear thrown around are only part of the solution. It's like running your company based upon a financial projection system. You can't do it. You need control on how the model is run. You need the ability to replicate historical results, and they all need to survive an audit. When you look at how you ended up trading around a position, you need good records on that to show that the controls are working.

You should look at what might go wrong. Make sure the data you're getting from your direct writers is current. On the whole issue of internal controls, you need to know who's watching over this. With corporate governance, you need to know who's going to be responsible overall. We know shared responsibility doesn't work; everybody blames the other side. Is it the asset side or the liability side that's going to manage this? How are you going to figure performance measures on this? Are you going to talk about how closely hedged you are between year-end? What's the cost of hedging? Make sure with regard to your performance goals that you're not rewarding bad performance. You don't want somebody not to be hedging in a down market, if that person is doing Delta hedging, just because that person has already spent his or her allocation for hedging.

What sort of limits are you going to have for out-of-balance? What's the maximum variance in your net position? What's the difference between your liabilities and your assets? Are you going to try to do that more on a cash-flow basis? Are you going to set some sort of limit by expiry date? Are you going to determine every year the expected debts or guaranteed withdrawals? Are you going to try to set limits on how closely matched you are there with an option? What sort of limits do you have on counter-party risk? Some of this stuff doesn't have a lot of market makers in the longer-duration option. How do you handle a big enough block counter-party risk? How are your limits going to react to closed markets? What are you going to do in that situation if the market is closed for a day or a week?

You need some sort of rules internally to govern how much you're going to trade. The more you trade, the more accurately you replicate what you need to balance, but you're going to have a lot greater trading cost. There is a cost to trade. You need to strike this balance between the two conflicting aims—high accuracy versus low trading cost. I think Ken said you should be looking at positions every week. Do you have simple rules where you're going to track a transaction every time the underlying portfolio changes by more than X percent? Are you going to do some other measure, like Delta or like Gamma, the moment you get outside range on those? If you're doing based upon Delta, if the Gamma is high then you should

reduce the Delta. That's going to require trading. All these trading rules are very hard to model in an options-based strategy.

The question overall is, what's the goal of the hedging strategy of the company? Is it to reduce earnings variance? Is it to reduce required capital? Or is it to reduce economic variance? This will lead you to three different conclusions on how you organize your hedging strategy. There's no hedging strategy that will match all of the above, so you have to make compromises in this hedging.

MR. DAVID HOPEWELL: I'm going to talk about the financial implications of hedging and try to pull together some of the different facts and observations that we've heard from our first two speakers. I spent roughly the first half of my career as a pricing and product development actuary at a company that long ago ceased to exist. I spent the second half of my career trading derivatives for the success of another company. About six months ago I joined Ernst & Young, because, frankly, they have many interesting problems to work on. I've really enjoyed the experience so far.

I want to talk about some of the financial reporting aspects of hedging. More to the point, I want to talk about the kinds of questions I get from CFOs who are looking at hedging programs. Because of the detail in hedging, calculating hedges is a fairly exotic, difficult and time-consuming process. There are a series of concerns that CFOs have in the application of a hedging program. Those concerns are presented in the context of accounting regimes, assumptions, the effect on the income statement and, to a lesser degree, the balance sheet. But they really are asking, what did these things do? What can I expect? How do I communicate this ahead of time to my various constituencies? When the numbers that are going to roll through actually roll through, I want to look like I know what I'm doing.

I want to start by discussing the different types of guarantees. A GMAB is a guarantee of just a pure return of premium at some point in the future. For instance, a variable annuity contract holder deposits $100 and they invest in the NASDAQ. They are going to get back $100 at the end of, for instance, 10 years, regardless of whether they invested that money in 1994 or in 2001. A guaranteed minimum death benefit (GMDB) is probably the most familiar benefit. I would almost call that the accidental benefit. Many years ago when the first GMDBs started, it was at least a little bit controversial even to have a return of premium. Many companies felt that return of premiums were give-aways. At least one large writer I know said, "Well, why do we need this at all?" They ended up having one and have since enhanced it. But at the time, at least, it almost sneaked into existence.

The next one is the GMIB. I, personally, have not worked with these other than as a derivative trader and telling pricing and product development actuaries to please don't make me hedge one. Because who's going to annuitize? Is it the 1 percent or 2 percent that currently annuitize? Or is it the 10 percent or 20 percent or more

who might annuitize if it's worth the trouble? We all have to pick numbers when we're given the problem to put a value on that. That has proven to be pretty tough.

Finally, we come to the guaranteed minimum withdrawal benefits. This is the benefit that may actually make income payouts go mainstream. Right now they are the only period-certain benefits of which I'm aware. If you're a variable annuity policyholder and you deposit $100 in your contract, if I'm a GMWB writer and I have terms like current mainstream writers, I'll let you take out $7.00 a year until you get all of your money back even if your account value is exhausted. If at the end of that time you still have account value, you can continue to withdraw money.

These are the accounting regimes that these benefits exist under. GMAB is clearly a FAS 133 mark-to-market liability for both the direct writer and the reinsurer. A little later I'll talk a little about FAS 133 and what it means to trade or to value something on a market-consistent basis, which is the language that FAS 133 uses. GMDB is an SOP liability. SOP in the case of GMDB is pretty unambiguous, but there are some questions about the scope and the applicability of it. I was surprised when I joined Ernst & Young accounting firm that GMDBs for a reinsurer was an SOP 03-1 liability. I couldn't figure out why. My thought was that if someone dies, the reinsurer settles the option with cash. Cash settlement is one of the primary criteria for a FAS 133 categorization. It turns out that in GMIB it does work that way. But in GMDB it does not, presumably because the claim that generates cash is an actual life claim, not the election of a life contingent benefit. I can value an option from first principles, but the people who decide on accounting treatments have my respect. GMIB clearly for a direct writer is an SOP 03-1. It's easy to see why, because the ultimate benefit is likely to have life contingent benefits.

For a reinsurer though, the issue becomes less clear. A reinsurer for a GMIB benefit, and there are a few out there, as well as direct writers, will find that if they pay off the present value of the claim at annuitization, then they have a derivative on their books subject to FAS 133 valuation and all that that implies. Whereas if they paid out the annuity election as the income stream, or as the excess of, for instance, the guaranteed income stream over the current income stream of the feeding company, they would have an SOP 03-1 liability. Incidentally, the holder —that is, the ceding company that has reinsurance of that nature—has an SOP direct writing liability but a FAS 133 reinsurance asset. I'm not sure if that was the intention when those contracts were made. It's a pretty substantial disjoint for those who experience it. Then finally, GMWB is clearly a FAS 133 liability driven solely by customer and policyholder election and not life contingency.

Now I'm going to discuss FAS 133 implementation. This is also something that in my life as a derivative trader seems quite clear-cut to me. Market-consistent valuation is one thing and one thing only. That is a risk-neutral simulation that can reproduce the prices of traded options in the marketplace. That's not actually the way it has been implemented with many, if not most, of the companies that I'm familiar with who have various FAS 133 benefits, including WB. This is an

interesting case of what I think may be financial reporting standards creating a competitive advantage. The largest writers of GMWB, have a potentially very complex hedge, which is appropriate given their large size, the concentration and visibility of their WB business and a correspondingly complex valuation. One of the characteristics of hedging WB in particular, is that the hedges are quite complex. They have a lot of moving parts, and accounting symmetry is very important. It is important to get the assumptions correct on the liabilities valuation side that are consistent with the actual hedges owned and the strategy followed to receive the credit that would be expected. In the case of companies with a very large GMWB liability, they're going to tend to do everything they can on the hedge side. They're going to need to do something correspondingly difficult on the liability side. That's an approach that takes a lot of maintenance, a lot of infrastructure and a lot of modeling. It both raises the visibility of the issue among the analyst community and it raises the bar for infrastructure for competitors that want to get into the market. That's an unusual consequence of accounting standards.

I have seen over the last five years, first working for a company and now for a advisory arm of an accounting firm, the movement toward what I would consider a more realistic implementation of FAS 133. That is an implementation that is consistent with and will reproduce the prices of traded derivatives.

Say there are two players in a market, and both players agree that the market either goes from a 100 to 101, or from 101 to 99, between today and tomorrow. What they don't agree on is the likelihood of that occurrence. One thinks the market is going to go up and the other thinks the market is going to go down. So those players want to sell each other an option. The question is, can they agree on a price? If they can agree on a price, what is it?

The quick answer to that is they can agree on a price, but only through risk-neutral valuation. If they insist on sticking to their real-world assumptions, there is not a market. If they agree to use risk-neutral valuation, they have everything they need to agree on a price, even though they don't know anything else about what the other thinks. They don't care anymore. That's why, in my opinion, a market valuation of options of any kind implies a risk-neutral approach. It's the only way there can be a market. Otherwise, everybody would disagree on the price and there would be no market.

I want to talk a little about the sources of income volatility. One of the things that's extremely important and hasn't been touched on yet is how extraordinarily sensitive to interest rates GMWBs, and to a lesser extent GMABs, are, and they're FAS 133-valued. Most companies seem to prefer to take the initial position that there are lots of interest rate risks to be taken and it all is sort of added together and amalgamated in the company's total risk position. Now that's dangerous to do with WB because of the FAS 133. Changes in market levels of interest rates are immediately transferred into the liability market.

I'm going to give you an anecdote of how big that can be. I think it was June 13, 2003, when interest rates were at their lowest level. About nine months later they had peaked or at least substantially come up. Over that time, The change in value of recently issued GWMB's was approximately 1.5% of account value, just from interest rates. That's an extraordinary number. That's why companies that write WB in any size have to hedge interest rates and that's why they have to have accounting symmetry. If you hedged and your accounting methodology wasn't consistent with your hedging approach and assumptions, some of that breakage would have come through in income.

Chart 13 gives you an example. Here I want to contradict both of our prior speakers. I don't mean to disrespect them at all, but there are ways to construct hedges that don't rely on greeks. This is an important thing to remember. All derivatives have two lives. They have their life in the risk-neutral world that determines their price and their price behavior, which lead to the greeks. They also have a life in the real world. That life in the real world is seen through their cash flows. Derivatives have cash flows. In fact, in many cases you can construct hedges without resorting to risk-neutral valuation at all, simply by understanding the cash flows of your available derivatives instruments and understanding the cash-flow behavior of liability under the market changes that lead to your derivative's cash flows and constructing a portfolio best fit. It's standard portfolio management stuff, and it doesn't require greeks or a whole separate infrastructure and calibration to run risk-neutral.

That's what I did in this case. This is a hedge that I constructed recently for a client. This was a simple product. This is a 10-year GMAB with a return of premium and a variety of fund tracks. The approach that we took to do this is quadratic local risk minimization. That means you find out what your tracking error is between the derivatives that you buy in claim, you square it and then you try to minimize the sum of your squares. It's a lot like regression.

Here's a basis-risk example for that very benefit. I think basis risk has come up. It's going to come up more. From the late 1990s to early 2000, basis risk was an enormous issue that nobody had really heard of because there weren't that many hedgers, at least there weren't that many hedgers of variable annuity account value against stock index. In the future it will be a bigger deal.

This basis risk is on a $200 million block of GMAB growing $50 million a quarter through four markets. Three of them are bulls, one of them is a raging bull that is over 60 percent in three years and one is a bear market. The three bull markets tell you that these are real-world outcomes. This is for funds that were 96 percent correlated with the S&P, which is not an unusual number for a subaccount or accounts with a small number of equity subaccounts.

One thing to notice is that there doesn't seem to be much correlation between basis risk and whether the market goes up or down. Another thing that surprised me

when I first saw it (and I eventually convinced myself that it's right) is that the basis risk is more often positive than negative. Now this was a surprise to me. This is how I rationalized it. The subaccount here was one that is composed of a bunch of equity funds, such as large cap, small cap, international, some bonds and some money markets. It was rebalanced according to the Ibbotson algorithm. For those of you who are not familiar with Ibbotson, what they've attempted to do is to sell as advice, fund rebalancing algorithms that presumably, at least based on historical relationships, will outperform an unmanaged index of the S&P. This graph starts out as something very much like a 60/40 mix of stocks and bonds. The separate account value is rebalanced once a year to the presumed Ibbotson mix at the time. That means we rebalance it to where it started.

The positive basis risk seems to be the result of that rebalanced fund mix, under the real-world assumptions that we use to simulate outperforming, and not a 60/40 mix that's left to drift. Ibbotson uses history to come up with a good fund rebalance. You calibrate some scenarios to history and you come up with the results that make Ibbotson look like genius. That's what I think happened here. If you believe that the historical relationships hold, it probably is true, though.

With regard to SOP 03-1 work, in a minute we're going to see that there seems to be two interpretations. One is the narrowing interpretation. That interpretation is that SOP applies mostly to enumerated types of benefits. The other interpretation says that it's very broad and that it's a catch-all for the entire set of liabilities that fall through the FAS 60 and FAS 97 cracks. I don't know which way to believe. I know what my firm believes. My firm thinks that SOP 03-1 applies broadly, not just to the enumerated benefits and obvious situations that are listed in the standard.

Chart 14 shows some of the cases that the standard does enumerate. I think we've also minimum guaranteed death benefits (MGDB). No-lapse guarantees are also discussed. Long-term care is another one. Earnings protection benefits are also mentioned in the standard. Then of course, mutual fund wrappers that act like the guarantees in variable annuities are discussed.

Now I'm going to go over a case study. Chart 15 shows a couple of things. There are several scenarios in this case. SOP 03-1 is a scenario-based valuation approach. The approach is modeled, at least to some degree, on deferred acquisition cost (DAC) methodology. That is that at any given point you come up with a K factor, and the K factor is what is called the benefit ratio. That K factor is applied to accumulated premiums. Then accumulated paid benefits are subtracted and you get a number that's either above or below zero. The four columns to the left of the benefit ratio column are the numbers that go into generating it. What I've called the "pathwise reserves" is something I did for my own education. That is the idea that along each path, what would you hold? For instance, if SOP acted like the new risk-based capital (RBC) rules in which you count the positives and you don't count the negatives subject to the set that you're interested in, those would be the numbers you'd put in it. The reserve, of course, in reality is zero. But it comes out to be

different from the average of the pathwise. This shows to me, frankly, that in most cases it's not a big deal.

As you go two years into the future, one of the things that's interesting here is that the magnitude of the reserve becomes much larger, particularly for scenario one. This points to something that's a general feature of guarantee hedging or guarantees in general. The new rules that are coming out, whether it's SOP 03-1 or the RBC statutory capital approach, tend to be very leveraged toward experience. Whereas in the past the difference in capital reserving between good experience and bad experience may have been a factor of two, now it might be a factor of 10, 20, 30 or 40. That, frankly, is one of the main motivations to get companies to hedge, because in a down market when everything is going wrong, not only are your benefits becoming more expensive, but your fee income is dropping, credit spreads are widening, interest rates are dropping and your mortgage pre-payments are increasing.

As I said before, GMWB puts new emphasis on how FAS 133 is implemented. The methods that have been used in the past for benefits that aren't hedged, and which have gotten auditor approval, will probably come under scrutiny, either from the auditing community or from the internal financial reporting community in each company. The scope of SOP 03-1 might be larger than expected, and, as I just said, early reserves may be very small. Bad experience can make them very large. There are substantial complications to hedging in terms of getting accounting symmetry, particularly with SOP 03-1.

For instance, it does not make provision to unlock interest rates. So if you want to do an interest rate hedge, because the yield curve is steep and you're doing a Delta hedge and you would rather have the long-term interest rate than the short-term interest rate, suddenly you have a derivative that's not offset by a change in liability, and that rolls through your income statement. There are other instances like that.

Chart 1

Fund Modeling Sample Results

		Weighted Average Results						
		-0.01%	30.62%	9.70%	14.63%	24.08%	10.50%	10.46%
		Regression Parameters						
Fund	Account Value (MM)	Alpha	S&P 500	Russell 2000	NASDAQ	Salomon BIG	EAFE	30D T Bill
Growth – 1	$ 9,900	% 0.18	% 41	% 20	% 39	% 0	% 0	% 0
Growth & Income Fund – 1	6,828	0.00	73	12	0	6	1	8
International – 1	6,726	-0.01	0	4	27	0	53	16
Asset Allocation – 1	5,978	-0.08	49	3	0	23	2	23
Gov't/AAA Securities – 1	3,520	-0.18	0	0	0	100	0	0
Gov't/AAA Securities – 2	2,581	-0.20	0	0	0	100	0	0
High-Income Bond – 1	2,520	-0.01	3	12	6	40	2	37
Bond – 2	1,456	-0.22	5	9	0	78	3	6
Growth – 2	898	0.15	41	20	39	0	0	0
International – 2	847	-0.03	0	4	27	0	53	16
Blue Chip – 2	690	-0.28	69	12	0	0	19	0
Bond – 1	646	-0.20	5	9	0	77	3	7
Asset Allocation – 2	557	-0.10	49	3	0	23	2	23
Blue Chip – 1	243	-0.26	70	11	0	0	19	0
High-Income Bond – 2	205	-0.02	3	21	6	40	2	37
Growth-Income – 2	204	-0.02	73	12	0	6	1	8
Global Small Cap – 1	164	0.57	0	46	34	0	21	0
Global Small Cap – 2	161	0.55	0	46	34	0	20	0
Cash Management – 1	149	-0.10	0	0	0	0	0	100
Cash Management – 2	117	-0.13	0	0	0	0	0	100
Global Growth – 1	107	0.32	0	9	36	0	46	9
Global Growth – 2	22	0.30	0	9	37	0	46	9
New World Fund – 1	13	-.0.05	6	33	9	23	30	0
New World Fund – 2	12	-0.08	6	33	9	23	29	0
Global Discovery – 1	8	-0.06	44	14	19	5	18	0
Global Discovery – 2	1	-0.07	46	15	18	4	17	0
Total/Weighted Average	***$ 44,554***	***% 0.01***	***% 30.62***	***% 9.70***	***% 14.63***	***% 24.08***	***% 10.50***	***% 10.46***

Chart 2

Fund Modeling

Fund Modeling Examples			
Fund	**Total Block**	**High Volatility Policy**	**Low Volatility Policy**
S&P 500	% 50	% 60	% 40
Russell 2000	10	20	10
NASDAQ	15	20	0
Bond	10	0	40
International	5	0	0
T-Bill	10	0	10
Volatility	**% 16.1**	**% 20.8**	**% 9.0**
CAGR	**8.3**	**9.0**	**7.7**

- R^2 of 90% is reasonable
- Regression analysis for each fund
- Individual policies viewed as a portfolio of index funds

Chart 3

VA Policyholder Research

Policyholder Behavior Analysis Asset Allocations by Issue Year								
Issue Year	Stocks		Bonds		Money Mkt & Fixed Accts		Volatility	
1995-2000	%	63	%	13	%	25	%	13.1
2001		56		20		24		11.4
2002		44		18		38		9.2
2003		42		22		36		8.9
Total Change	%	-21	%	9	%	11	%	-4.2

- Market downturn has changed behavior
- Women select less aggressive allocations than men (0.5% lower volatility
- No anti-selection by benefit type

Policyholder Behavior Analysis Asset Allocations by Age Group		
Issue Age	Volatility	
0 to 49	%	12.6
50 to 59		11.4
60 to 69		9.8
70 to 79		8.5
80+		8.0

Chart 4

GMIB Hedge Costs

GMIB Hedge Costs Max of 5% Rollup & MAV		
Issue Age 60 *Standard Assumptions*		
Asset Allocation		**Hedge Cost**
Aggressive	%	0.47
Moderately Aggressive	%	0.42
Moderate	%	0.36
Moderately Conservative	%	0.34
Conservative	%	0.26

Chart 5

GMWB Hedge Cost

GMWB Hedging Analysis 7% Max GMWB	
Asset Allocation	**Hedge Cost**
S&P 500	% 0.89
Aggressive	0.57
Moderately Aggressive	0.37
Moderate	0.14
Moderately Conservative	0.02
Conservative	0.00

*Asset allocation has a significant impact.

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Chart 6

GMWB Hedge Cost by Cohort

GMWB Hedging Analysis 7% Max GMWB	
Cohort	**Hedge Cost**
Withdraw 4% Immediately	% 0.15
Withdraw 7% After 3 Years	0.42
Withdraw 7% After 5 Years	0.30
Dynamic Withdrawals	0.27
No Withdrawals	0.00
Total	**% 0.25**

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Chart 7

Key Rate Rho

GMWB Key Rate Rho	
Maturity	**% of Rho Explained**
1-3	-0.1%
3-6	15.2%
7-10	33.5%
11-15	33.7%
16-30	17.7%
Total	**% 0.25**

Chart 8

Dynamic Hedging Example

- $1 Billion of business
- GMWB Rider
  - 7% Withdrawal Benefit
  - 5 year ratchet
- 5 year projection with weekly time steps
- Simulation over 50 real-world scenarios of market returns, swap curves, implied volatility curves
- Hedging Strategy :
  - Delta : futures, options
  - Vega : options
  - Rho : swaps, options

Chart 9

GMWB Hedging

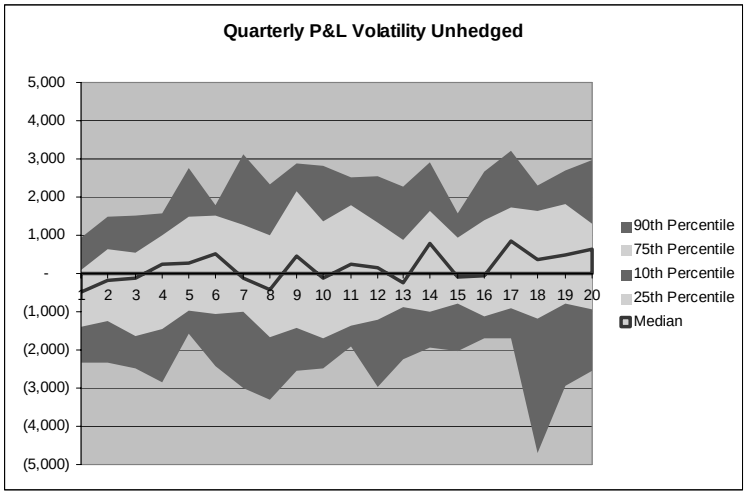

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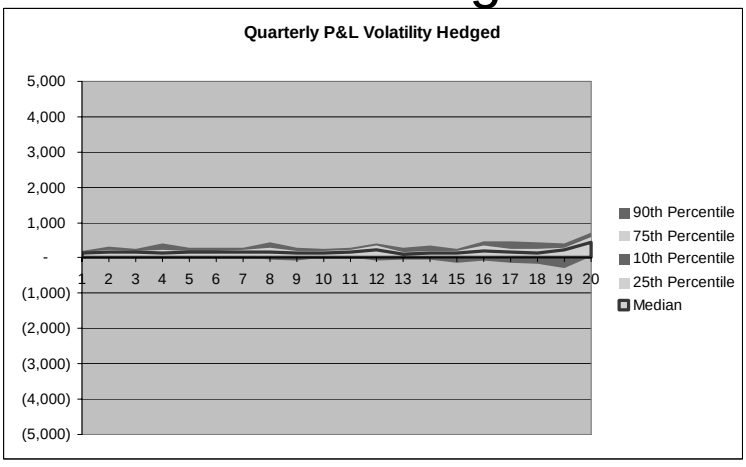
Chart 10

GMWB Hedged



Hedged with Futures, Short & Long Term Puts, & Swaps

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Chart 11

CIGNA – As of June 30, 2004

- Reinsurance assumed book of business
- Fair value of mutual funds ? $47 billion
- Death benefit coverage in force ? $11 billion
- Future policy benefit reserves for GMDB ? $1.1 billion
- Notional amount of the futures and forward contract positions ? $1.7 billion
- Recorded in other revenues pre-tax losses on future and forward contracts
  - Quarter ended 06/30/04 – ($29 million)
  - Six Months ended 06/30/04 – ($60 million)
  - Quarter ended 06/30/03 – ($312 million)
  - Six Months ended 06/30/03 – ($256 million)

Source: CIGNA Corporation form 10-Q for the quarterly period ending June 30, 2004

Chart 12

Lincoln National – As of June 30, 2004

- Quarterly changes in values for the GMDB reserves and the hedging contracts may not move in an offsetting manner
- LNC intends to continue to hedge its long-term GMDB exposure in order to mitigate the risk associated with falling equity markets
- Account balances covered in this hedging program combined with account balances for which there is no death benefit represent approximately 53% of total variable annuity account balances
- LNC expects to continue expanding the coverage of its GMDB hedging program on an opportunistic basis, as the underlying account values increase due to equity market appreciation
- Hedging program reflects benefit designs of the segment's products and has been effective to date
- LNC continues to evaluate various hedging tools and opportunities as it considers additional benefits, product features, and alternative hedging strategies**.**

Source: Lincoln National Corporation form 10-Q for the quarterly period ending June 30, 2004

Chart 13

GMAB Basis Risk Example

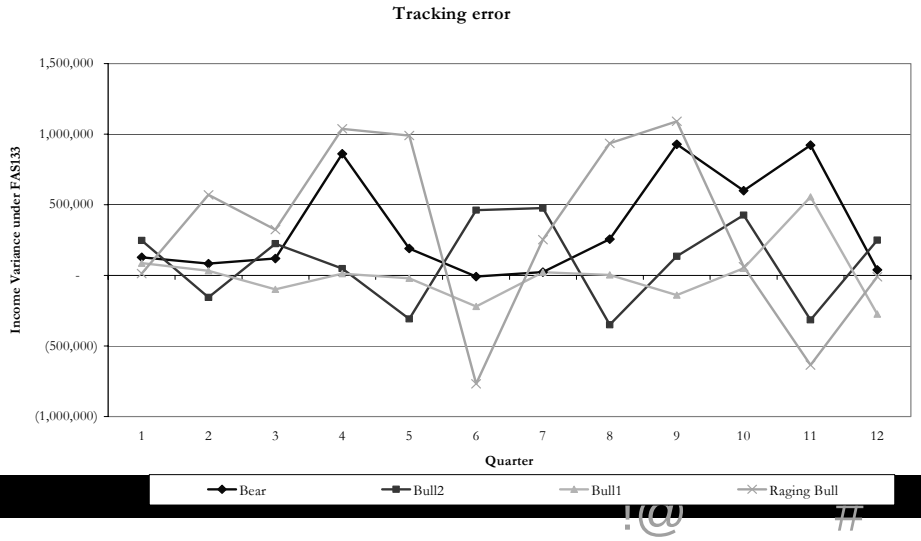

Chart 14

SOP03-1 Scope

Some Explicit Provisions

1. Minimum guaranteed death benefits (MGDB) provided under variable annuity contracts

2. No-lapse guarantees that keep universal life (UL) and variable universal life (VUL) contracts in force when the account balance is zero and premiums are insufficient to cover the cost of insurance plus all other contract charges (paragraph 3);

3. Long-term care or similar insurance benefits provided during the accumulation phase of a deferred annuity (paragraph D21);

4. Earnings protection benefits on deferred annuities that pay a death benefit in excess of account balance to cover taxes on contract earnings (paragraph D22); and

5. MGDB or other insurance benefits provided with mutual fund or other noninsurance contracts (paragraph 30).

Chart 15

SOP03-1 Case Study

Time = 1

	Acc DB	Acc Prem	PV(DB)	PV(Prem)	Benefit Ratio	*Pathwise Reserve**	Reserve
Scenario 1	13	42	859	2,316	0.3701	*2.07*	**(4.86)**
Scenario 2	13	42	346	2,658	0.1331	*-7.87*	
Scenario 3	13	42	474	3,294	0.1461	*-7.32*	

Time = 24

	Acc DB	Acc Prem	PV(DB)	PV(Prem)	Benefit Ratio	*Pathwise Reserve**	Reserve
Scenario 1	284	1,024	594	1,742	0.3173	*40.93*	**(57.60)**
Scenario 2	284	1,024	263	1,989	0.1817	*-98.02*	
Scenario 3	284	1,024	329	2,416	0.1783	*-101.45*	

* Just for comparision purposes, doesn't exist in SOP