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Risk Management Behind Variable Annuities

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Moderator: ARI JOSEPH LINDNER

Panelists: GEORGE E. CHRISTOPHER†

LANCE R. BERTHIAUME

Recorder: ARI JOSEPH LINDNER

Summary: Competition is accelerating in the variable annuity marketplace. Companies vying for distribution shelf space are introducing innovative product features in an effort to differentiate themselves. The innovative features, such as enhanced guaranteed minimum death benefits and guaranteed living benefits, have introduced new risks into variable annuity portfolios. Panelists discuss various techniques employed by insurers for managing the risks inherent in their variable annuity portfolios.

Mr. Ari Joseph Lindner: With me today are George Christopher from the esteemed firm of Milliman & Robertson (M&R) and Lance Berthiaume from the equally esteemed firm of Tillinghast-Towers Perrin.

We are going to be discussing risk management behind variable annuities (VAs). George is going to start out by talking about guaranteed minimum death benefit (GMDB) risks and some of the risk management tools. I'm going to talk about general death and living benefit risk categories, the types of risk, and the advantages and disadvantages of the types of risk management tools available. Lance is then going to talk about risk management tools, focusing specifically on dynamic hedging and some of the specifics involved.

Mr. George E. Christopher: I'm going to talk about different types of GMDBs and the various risks, and then I am going to talk about a couple ways that you can manage these risks. Let's talk about these in roughly their order of increasing risk. Let's start out with ones that don't pose too much of a risk to a company that's writing them and then we will get to ones that are a little more risky relative to the other types of benefits.

One of the simpler forms is just a waiver of surrender charge. These GMDBs kick in when you have an annuity and you happen to die before you annuitize—you get some sort of guarantee on the death benefit. Waiver of surrender charge is the first one. It's not really a new or racy benefit. This is a fairly traditional thing.

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†Mr. Christopher, not a member of the sponsoring organizations, is with Milliman & Robertson in Chicago, IL.

You get rid of the surrender charge if someone is unfortunate enough to need their death benefit before the surrender charge period is over. Risk is fairly low and in order to manage a risk like this you'd use fairly traditional actuarial-type techniques to water down the risk and hope that everybody doesn't die at the same time basically. Secondly, there is a return of premium benefit. It's also fairly low risk. The death benefit would be the minimum of the account value minus the surrender charge and the premium that you paid, so if your account value takes a nosedive right after you buy the policy and you are unfortunate enough to die, you'd still get your premium back as a death benefit. Again, it's fairly low risk, at least compared to some of the other ones that we'll talk about. Traditional management techniques work fairly well. You can also reinsure these or you can try some static or dynamic hedging.

We're starting to get into more risky risk management techniques such as a reset. Periodically, a death benefit will be set equal to the account value that's accumulated behind your product that you've bought. The reset has a moderate risk.

The real risk here is that your account value will go up. Let's say it resets every two years. If you were invested in the NASDAQ and your reset was, say, the middle of January or the beginning of February, between then and now the NASDAQ's gone down so the company has a little bit of risk there. It will have to come up with a difference between the current value and the index and whatever the value was the last time that you reset if you were to happen to die anytime until the next reset.

Moderate risk. If you have a longer period reset the risk could be a little bit longer because you may be unfortunate enough to have had someone reset right at the very top and then the market goes down afterwards.

For risk management techniques, the insurance, over-the-counter options work fairly well, as well as static and dynamic hedging and, to some extent securitization, although there are a lot of drawbacks right now.

Another type is a ratchet. A ratchet is kind of like a reset except you're never allowed to go down so periodically your death benefit would be set equal to the larger of your existing death benefits or your current account value. Risk management techniques, again, include reinsurance, over-the-counter options, static and dynamic hedging, or securitization. For the ratchet and the reset, writing a lot of policies or diversification among policyholders isn't really something that you want to do because everybody will ratchet up at the same time when the market's doing well and then when the market comes down, suddenly you have an enormous risk that could actually end the company.

The final common type that I'll mention is a roll-up. Your benefit just rolls up at a certain fixed interest rate that's determined ahead of time in the contract every year, every so many policy periods, or it could even be on a continuous basis. Again, this is a fairly high risk. You could think in terms of comparing this to a ratchet. Once you go underwater on a roll-up, once something gets in the money

for the beneficiary, things only get worse. Not only do you have to get back to that same level that you were at, but that level is growing as time goes by. Risk management techniques, again, include reinsurance, over-the-counter options, static and dynamic hedging, and securitization. There are a few others that combine some of these basic benefit types.

One that's actually been tried in a couple places is doing a ratchet on the maximum of several benchmarks. So, for instance, if you have \$100 in your account, the S&P is up 15% and the NASDAQ is up 20%, you may have one that ratchets according to the maximum of the S&P and the NASDAQ and then you would go up 20% per year. These are particularly dangerous because they are very difficult to hedge, especially if you have very diverse indexes that you're taking the maximum of because, on average, one of them will up if you have things that are diverse enough. Each year the benefits will go up and you'll have to come up with an involved scheme to figure out how you can cover those benefits.

I'm going to switch gears here and talk a bit about three types of risks that can be associated with GMDBs. First is the timing and vitality risk. Policyholders might not cooperate and dial in when the markets are up. That's what you would hope.

I mean the market hits a new high, everybody resets, then policyholders die. The market hits a new high and starts going down after everyone's reset. You hope that they figure out some way to live until the market has gotten back up to the high to where it was before. How would you minimize this risk? One of the ways is during product design you have longer periods between ratchets. The idea is that over longer periods of time, individual quick volatility issues that may come up will average out.

Then, we have the resets having a little bit less risk than ratchets. If you have a situation where some asset really get out of hand and that person has invested in it, you're only going to have to worry about that exposure until the next reset. For instance, maybe someone was invested completely in Internet stocks and when it comes back to earth, if you've written them a reset, you're in a lot better shape than a ratchet. Whereas you're stuck with a ratchet until the Internet stocks get back up to whatever their level was or the last time there was a ratchet.

A brief mention of behavior risk. There are lapses. People don't always keep their policies until the end of the period. Economic theory would say that the policyholders should do what's best for themselves and not for the company so you should not expect too many lapses. Usually lapses will end up helping you because if they lapse when there's no risk for you, you're no worse off than you were before. You are not going to be collecting premium—that might make you a little upset, but it's not going to increase your risk. If they do have a large difference between the death benefit and the account value, and then they lapse their policy, that's great for you because suddenly you've gone off risk without having to pay them any money. If they died, you'd have to come up with the difference between the death benefit and the account value.

Partial withdrawals is a situation that can be really scary especially if your product hasn't quite been designed with partial withdrawals in mind when you designed it. If your death benefit is approximately twice your account value, markets could go down quite a bit, whatever the underlying account is invested in. If a policyholder removes \$45 from the account, that leaves \$5 account value and the question is, What's the death benefit? If you set it up so that the death benefit is proportional to the amount of the account value that's left, they'll have a \$10 death benefit. Still, \$10 compared to \$5 is not the best.

However, if it's been set up in another way you could take that \$45, subtract it from the death benefit, leaving them with the \$55 death benefit with a \$5 account value to support it. You're going to be in a lot of trouble then because, not only are you going to have to come up with \$50 upon death, you're not going to be collecting premiums because the account value is only \$5, no matter how many basis points of that \$5 you're collecting. It's never going to amount to the \$55 that you need, so you have to be a little careful with policyholder behavior. You have to anticipate what may happen ahead of time. Friendly market risk, i.e., market fluctuations, can expose you to risk. That's sort of the whole point of this talk.

This can be managed after the fact since there are hedges available. For example, we'll take a look at how these risks affect the ratchet. It's pretty clear that your exposure has gone up. Some of these ratcheted in at \$100, whatever they've invested in, are now only worth \$80; you have to come up with the \$20 if they die in the near future.

However, market gains also cause problems. Say someone has \$100 invested, their account value goes up to \$200, and the ratchet occurs; now they have a potential \$200 death benefit. If whatever their assets are drop by 50% now, you're on the hook for \$100, not the \$50 you would have been on the hook for before the ratchet. So, this is a significant risk. Immediate drops generate immediate exposure and increases actually generate more potential exposure in the future if the market were to drop again.

The one thing that's dangerous is to separate the risks associated with the death benefit completely from whatever product that's been tied on it. One of the reasons is that you may be getting 150 basis points in total from the account for the annuity with the death benefit if you've tacked this onto an annuity, but only 20 basis points of that is explicitly for this GMDB. What's going to happen? If somebody goes through an annuitization, that's great. That means they never died.

None of this exposure that may or may not have been generated ever has to come out of your pocket as an insurance company so you get the 150 basis points a year to pay only for that risk. However, if they do die at some point along the way, all of that 150 basis points for the annuity has now, in a sense, been funneled into the GMDB.

Some of it gets siphoned off for commissions and expenses and things, but if you start trying to look at these as x-basis points for annuity and y-basis points for the

death benefit, you can get into a little bit of trouble because those y-basis points will need to be fairly large and you can run into problems thinking about the risks separately.

Let's talk a little bit about ways to manage the risks. The traditional approach is to diversify your risk away by writing a lot of policies. Cost is very low. This is what insurance companies do. This is what they've always done. It works well for return of premium and waiver of surrender charges. Those don't really generate too much exposure unless you're in a really bad situation. If you're looking at a ratchet or reset, what could you be doing? You're just multiplying the risks by writing more and attempting to diversify by writing more policies.

What about reinsurance? The idea is to pay somebody else to pay for the losses. It works great for all the GMDBs; it's easily customizable. If you can find somebody out there that will write your reinsurance for your death benefits, great. The problem is that there's limited availability now. There was a lot available before reinsurers wrote a lot of reinsurance for these benefits and then suddenly awoke and said, "Wait a minute, we have these huge potential liabilities and have sort of cut off the spigot there for the reinsurance market." Since there are very few people out there doing it now, it can also be very expensive and you may end up actually locking in a loss if you purchase reinsurance.

This also ties back to the point about trying not to separate the death benefits from the annuities. The reinsurers are going to want to charge you a little bit more for the death benefits. If you're just giving them the death benefits because they don't get the subsidy from the basis points collected on the base annuity that never got paid out because the person died before annuitizing it, it tends to look a little more expensive.

Just trade over-the-counter options with an investment bank. Again, it works fairly well and is easily customized, but these are even more expensive and they almost always will guarantee you a loss if you start trying to take this approach.

Securitization. You could bundle up all your risks into a CAT bond. They can reduce your risk in most scenarios. Most of the time your risk will be a little bit smaller and more palatable. The downside is that the bonds are very hard to sell. I'm not sure that a deal has actually gone through on these. There's some trouble getting these out. It doesn't really help with the worst-case scenario because once you've eaten through the principal and the bond, if you still have another billion dollars in liability, you've eaten through the principal and the CAT bond and you're back on the hook again.

There are also some fairly large fees associated with putting these together and getting these deals going. Another idea is static hedging. You just horde some exchange traded derivatives—maybe some futures contracts, maybe some puts or calls, anything that's out there on the exchange. The upside is that they can be a great short-term hedge. If you're looking at something that's over a short-term

time horizon, this could be a great way to minimize your risk. It's also relatively simple.

These things are out there on the exchange. They've been out there for awhile. People understand them fairly well. You probably won't have to hire new people to come in and explain to you how an equity put or something like that works. The downside is they are relatively expensive. Traders take pretty large spreads out of there and they build in a lot of juice so they can make a little profit too and they don't really mirror the GMDB risk very well. If you go out and buy an exchange traded put on the S & P index at 600, that put's always going to be at 600. As the market goes up and people start ratcheting, your risk may be for a put at 650 instead of 600 because their death benefit has increased and it still keeps you hedged. You're on the scary tail part of the distribution, but you've generated yourself a little bit of exposure there.

Finally, and perhaps most interesting, is dynamic hedging. We'll have more explanation of dynamic hedging in a bit. Replicate the risk that you have by trading derivatives. You can go through and quantify the risk associated with these things or at least stochastically you can go through and look at a distribution of what your risks may look like at given returns from the market.

The upside is you can substantially reduce risk. You can't quite eliminate it because you'll never know if overnight something is going to happen that will cause the market to react faster than you can readjust your hedge. Things like this have happened recently. It's fairly affordable. If you go out and trade futures contracts, that can be done reasonably cheaply. The downside is it may require development of new expertise. Either you may have to learn yourself or you may have to get a bunch of your staff to learn how to handle these things. You may have to go out and find someone from outside your company to come in and show you how these dynamic hedging programs work. In general, I think this is probably the best way to go. If you have the time and the resources to devote to learning how to do it, this is the one that will be the most effective in the long run.

Mr. Lindner: I want to expand a little bit more and go outside of the death benefit and talk about some of the other living benefits, say the more complicated benefits that are being covered in the marketplace today. I'll talk a little bit more specifically about the amount of risk definitions because as everybody knows, actuaries love formulas. I'll also talk again about some of the risk management tools and the advantages and disadvantages of dynamic hedging. I'll begin with the product and the risk definition. We have, of course, the GMDB, which up until five or six years ago, none made their way on to the scene as anything that exciting.

The death benefit began to be enhanced and these other benefits were added. They've started to add these roll-ups and ratchets. The net-amount-at-risk (NAR) definition for a death benefit is simply the death benefit less the account value, payable at the time of death, so what risks now are we talking about that are involved in this?

There's a significant market risk—market movements, volatility, changes in volatility, changes in your assumptions of market returns; obviously, volatility has been big over the last couple of years. Markets are crazy every day. If the market doesn't move 5%, nobody cares so that's a significant change from where we were just five or ten years ago. The transfer risk. You never know when your policyholders are going to transfer their money from equities to fixed income or back. Will they exhibit a sort of buy-high, sell-low mentality? That will work against you because now you're on the hook for their investment decisions.

Basis risk is always going to be in there, whenever you're involved in any hedging on any indexes, because after we manage funds they are not going to behave similar to the index. In addition, all of these funds have extra fees dragging on them that are going to make them not replicate indexes easily because of the timing risk. You can't buy a \$40,000 hedge on Tuesday because somebody bought a \$40,000 policy. You have to accumulate, wait; maybe you can buy one a month, a quarter, depending on how big a writer you are. In certain cases, even one a year may be outside of your reach. What you have now is people who bought into their policies at all different levels—at January NASDAQ levels, June NASDAQ levels, March NASDAQ levels—and you have a hedge that will not cover them perfectly and will not mirror the way that the money was deposited. Obviously, mortality is going to be a major risk because this is the way that people exercise the option.

So if mortality moves against you or for you, that will have a major impact on the death benefit and persistency, because as George was just saying, perceive in a vacuum—the death benefit benefits from lower persistency. That is, you don't have to pay if they leave. Now the caveat to that is that if you've purchased static options up-front with the large up-front cost and everybody lapses, then you have no money to pay it back. But, otherwise, lapsing is generally good. Again, perceived in a vacuum.

The guaranteed minimum income benefit (GMIB) has a similar NAR although the risk amount is now the present value of the income benefit payments multiplied by the guaranteed rates. The difference between that and the current account value at current rates has a lot more moving pieces to it—interest rates are going to move around, your current annuitization rates may move around, and it's payable whenever they want after a waiting period so there's a lot more optionality built in. Again, the risks are the same. Market, transfer, basis, and timing risk. Persistency here includes mortality because whether they die or lapse of their own volition, they can't elect to annuitize. So, in this case, annuitization, the rate at which they take, exercise the option and here the problem is nobody knows what it will be. Will it be more than current annuitization rates, as seen in the money option? Sure. Will it be 5% a year, 20%, 80%? Nobody really knows. So you're on the hook for the word getting around that everybody has a great benefit and you better use it now for some reason or here's something you can use today and really having a lot of utilization at a time when you wished people would just hold on and wait for the market to come back.

The guaranteed maturity accumulation benefit (GMAB) is very simple. Just like a put option, it pays the difference between the GMAB value and the account value at a given maturity date. Here you have just the market risks that we talked about and the persistency, which includes mortality again. They die or lapse, volition doesn't matter; you don't have to pay.

But, otherwise, everybody who's there at the maturity date exercises the option automatically. That can be good or that can be bad, depending on what type of risk management scheme you have. If you want to peg down when people are going to exercise so that you can have options that more accurately reflect the exercise rate, that's great. If you're a little concerned about the company going out of business if the market tanks at the wrong time, then you may have some problems.

To continue just briefly with the other products out there right now, the immediate payout annuities have floors that are being added—paying the difference between the guaranteed floor payment and whatever the actual calculated payment is—every month starting when one falls below the other. Here there's no persistency involved but if mortality for some reason goes through the roof, that's good. If everybody starts living to 200 you may have a problem. There are these other sort of newer benefits in the marketplace, calling it a reversed GMAB for no other reason than it pays more when the market goes up as opposed to when the market goes down. It's intended to help beneficiaries pay for the taxes on the growth. It pays a percentage of the growth at death.

No-lapse guarantees on variable life which basically pay the insurance charges once the account value available reaches zero so that the policy never lapses. Now of the various ways to manage the risk, the most efficient and the easiest and the one that will get you the most cost-effectiveness and require the least effort and cost is to make changes in benefit design. These you see already in a lot of policies—for example, issue-age limits. If you issue your death benefit to a 95-year-old, you're asking for trouble.

If you limit the enhanced benefits, for instance, to issue-age 75 and the basic benefit to issue-age 90, what you find is that you don't incur as much risk because the mortality rates are not as high so you tend to cut down on the claims. In addition it will reduce your cost of reinsurance if you chose to use that as a risk management tool. It will reduce the notional amount you need for hedging purposes. It will reduce any residual costs that you may be retaining and it reduces antiselection so that you don't have a person on his or her death bed buying more annuity so he or she can play the stock market for a couple of months on you. Attained age limits have the same basic principles. You kick them out at a certain age. My maximum annuitization age is a good example. They can't collect on a death benefit once they reach their maximum annuitization age and are required to annuitize. The enhanced benefit, a roll-up or a ratchet, freezes at a certain attained age at 85, on this example, and no longer continues to roll up.

So this again reduces the claim; it reduces the strike and the duration of any hedges that you might be buying. It will reduce the reinsurance costs and the residual costs that you're retaining. It doesn't have as much to do with antiselection but it helps out. Then you have benefit limits that many companies have, such as 5% roll-ups that stop at twice the initial premium. Why? Well, again, you reduce the strike on a hedge, you're reducing the cost of reinsurance, and you're reducing the residual. Everything gets capped off at a certain time.

There can be asset distribution or asset transfer limits. These two are specifically for maturity guarantees. This may apply only to the S&P fund, like the Traveler's product, or if the investor maintains a pre-specified asset mix. I believe the Guardian has one like that. This just helps cut down on your basis risk and the claims, the cost of reinsurance, all those risks we talked about. The more optionality you give the policyholder, the more difficult it is to manage on the back-end and then eliminate antiselective features.

George talked about partial withdrawals. I had a nice little example I was going to talk about but he already gave one. Suffice to say that if, in a poor market environment, somebody takes out the majority of his funds, he ends up with free life insurance. That's really the simplest way to put it. You may ask, who but an actuary would think to do that, but personally I like to talk about the Oprah Winfrey, or the Today Show factor; that is, the market tanks, and everybody wants to know what do I do with my investments. Oprah comes on and says, "Hey, everybody bought a VA, free life insurance," you better believe people are going to do it. That's it for the benefit design.

To move on, reinsurance is a very popular form of risk management. Why think about it when I can pay somebody else to think about it? If I give it away, I can go on vacation. It's not always that easy. What are the advantages of reinsurance? Well, it tends to be compared to derivatives, a more perfect hedge. There's no basis risk, no drift, you don't have to worry about matching the expenses with the drags and the funds, none of that. The premiums and the claims, all the timing matches, you can get paid from the reinsurer and you pay them the same way you get paid from the policyholder, which is on a monthly basis. Everything matches better, the timing matches and you can pay over time; you don't have to pay up front for the cost of any derivatives. You can create a unique risk retention. You can slice and dice this risk a number of different ways: quota shares and annual limits as a percentage of the account value, the death benefits, flat dollar limits. You can make all kinds of tranche layers and carve out whatever risk you like or whatever risk you want to get rid of and split it up amongst a number of different parties.

I think an easier way to do that is with derivatives directly. It requires less ongoing risk management efforts and expertise. It doesn't take a whole staff of capital market analysts to put together a reinsurance agreement and to monitor it over time and put together another one in a couple of years when that one dies. You don't have to have the same kind of effort that's involved with dynamic hedging, for instance, where, as George said, the market may move in the span of five

seconds and your hedge is no longer valid so you have to have somebody monitor that. You have to pay that person to come on board—either buy or train somebody. Reinsurance is useful both on an individual product and a portfolio level and that will help you as opposed to derivatives, which have a critical mass issue.

You can have a very small block of business, for example, a very small rider, and still benefit from this risk management tool. The disadvantages are that it can be expensive. Sometimes, you can't get coverage at any cost. Other times it may seem like the cost of the reinsurance is wildly out of proportion to what you figure, or somebody else thinks, or the marketers say that it should be.

It can be difficult and time-consuming to design an effective agreement where the reinsurer and the ceder are happy with the portions of risk that they are each taking and the cost of each and so on. There's also a credit risk that you don't have as much of with hedging. When you buy an option to cover your death benefit risk, it's a very small part of a bank's book. It's nothing. You don't have to worry that the bank isn't going to be there to pay that off. It has a lot of bigger fish going on than your transaction, whereas for an insurer, it can be a significant event; it can be a significant part of their business and something to think about. Regulations require you to take this into account and there will always be some kind of limit on the risk coverage.

Some of you may have been fortunate enough to get reinsurance, at some point in the past, without limits, but I know it doesn't exist anymore. There will either be time limits, or claims limits—the types of things I talked about before—where you're carving out different tranches of the risk to cover. Nobody today can you call and say here's my product, you cover all the risks, you pay me 30 basis points, good night and go on vacation. You can't do it anymore. There is always going to be something leftover for you.

You can get unlimited coverage in the capital markets. If you buy a put and it pays the difference between the strike and the value of the fund, if the value of the fund goes to zero, it goes to zero. They pay the whole thing, so to move that into derivatives the advantages and disadvantages are pretty much a mirror of the reinsurance. There will almost always be coverage available at some price.

There will be some place where you can't buy coverage, but in general if you're willing to pay enough, you can get coverage from a bank for a certain risk. You can transfer the risk right away. Today, you can buy a put option in one day. You don't have to spend weeks designing a reinsurance agreement, coming to terms, signing, and faxing back-and-forth. If you want to buy one, it's there. There're always there, willing to see to you. The credit risk is reduced and the coverage can be unlimited. The disadvantage is that you have basis risk, all those things we talked about: the timing doesn't match, the actively-managed funds, and when there's a claim your reinsurance payments aren't going to match what you paid out, and transfers and withdrawals get all mixed up as people move their money around. If the market tanks and everybody goes into bonds and you're left with derivatives on equities, you have this complete mismatch and you can't sell those options now

because the market's gone down. Let's just say you have a mismatch—the claims and timing won't match. The payment is usually on options required up-front so it's not the same as the way you get it in.

Now you have a lapse problem where, if there are too many lapses, then you don't have enough money to pay off the up-front cost that you pay for the options and, to a certain degree, the customization is limited. It's almost as much trouble, or it will be more trouble, I think, to design a very specific private placement option that's not traded that gets you the same type of risk retention tranche layers, almost in terms of a securitization. It just requires a lot of effort. The customization that you can get pretty easily with reinsurers, where you want this slice or that slice and they'll tell you how much it costs, is not as easy to come by with derivatives.

You need a significant ongoing risk management team. You need people who understand options and how they work, the derivatives, especially if they're going to have a dynamic hedging portfolio and hedge on the Greeks. You need people who are going to follow it on an intraday basis and make sure that it balances all right. You need a critical mass. If you're a \$100 million annual VA writer and the market drops 20%, you have a \$20 million amount at risk. If mortality is 1%, you have \$200,000 exposure. You cannot have an option for \$200,000 notional. You can hardly borrow it for \$2 million. You're priced out of the capital markets. You don't have enough material to be able to participate, so you have to consider that.

Only the largest writers or the large writers with a lot of risk involved or large in-force blocks can make efficient use of the options that are available. A lot of times it may only be used on a portfolio basis. You can't send your prospectus to Goldman Sachs or a bank and say please cover exactly this risk. They aren't going to do it.

You have some regulatory risk with the way the options are used and how they count against your reserves and capital usage that may change. In fact, how it is done currently is it's still kind of being felt out and the derivatives dealers probably are not going to take you to dinner. So after you're done with that, you have something left over.

Whether you buy in the capital markets and you have basis risks and all those timing mismatches, or whether you buy it from a reinsurer and you're left with the tail or the beginning or half of the middle, whatever it is; the first thing you have to figure out is what your goals are when you decide to manage the risk of your VA portfolio.

Do you want to reduce the impact of disaster scenarios? Is that your only goal or do you want to cut off the tail? A lot of times, that can be done with derivatives. You have to decide what you want to do or if you want to reduce the income statement volatility.

You want some kind of smoothing program, something where you're willing to take the claims; you just don't want them all day. I'll pay them over ten years if there

are claims or do you want to retain as little of the risk as possible? Now, you sort of shift it to the other side, maybe you said to look at reinsurance. Reinsurance is a place where you can get rid of a lot of the risk, but not all of it. Finally, what you have to consider is the profitability of the piece of the risk that you retain. We are all in the business of taking on risks for a certain premium, so there's always going to be something you're left with and it's easy to point at reinsurance or derivatives or whatever and say that costs too much.

Everybody else is charging this, my marketers say it costs this, and this is how much it should cost, I don't understand why you're charging that much, but if you consider yourself a stochastic or some type of model that is going to tell you what the profitability is, what's the return on the capital you're going to use for the risk that you retain? If it's 6% or 7% now you've affected the profitability of your whole product, so that's something to think about. A lot of people don't go to that level. The risk is going to have a catastrophic profile, something that a lot of traditional life insurers are not used to thinking about. This is more on the property side. It's high-severity, low-frequency. It doesn't happen very often but when it does it's a killer, so you have to think of it in those terms. Standard delineation may not be a sufficient charge to cover the risk. Again, every risk management tool is going to leave you with something, so you may want to move the risk around internally. That may be another option, if you're an international company, to take advantage of more favorable regulations or tax structures – that's one way to deal with the risk that you've kept, but at the end of the day you have to think about what that's costing you and whether it's profitable.

So what can we conclude? You have to be careful with the product and the benefit design. It's the most efficient way to manage the risk; you get the biggest risk reduction for the least effort and the least cost. It may involve making the structure more restrictive for the policyholder. Your marketers may not like it, but if you put it in terms of you can have this very small optionality for the policyholder, but it doubles the cost of the risk management, then they might think about it a different way so you don't get something for nothing. If you want an expensive structure with a lot of options for the policyholder, then you have some risk management problems because the more you're going to let them do, the more you have to start thinking about what they are going to do, when they are going to do it and how you can protect yourself. Whereas, if you restrict them to something very simple—the easiest example is the Traveler's Index Annuity, S&P only, pays exactly what you put in—you have a much better feel for what that risk looks like without all these other fluctuations. You don't have to manage risks that you don't take on. You can't put it any simpler than that and the best tools, the best reinsurance, the best dynamic hedging strategy, whatever, will not fix any problem that you have with poor design. No risk management strategy is going to fix the partial withdrawal problem if your death benefits reduce dollar for dollar with partial withdrawals. You have an anti-selection problem. You could have a bunch of people with free life insurance and be in a lot of trouble.

Reinsurance may be preferable to using derivatives. Now why would I say this after all these advantages and disadvantages? Primarily because most companies will

have a critical mass problem. Derivatives are going to be difficult to use for critical mass and a lot of companies simply don't have the expertise to enter into dynamic hedging programs. They either have to hire it outside or hire it inside. But whatever you have to do it's a project. It's not something you can ask Joe the actuarial student to do on his lunch break. It's costly and it's something that you have to make sure that you do right or it's not effective. Derivatives may be more useful if your goal is to dampen the effects of dangerous scenarios. They may not be as useful if your goal was to get rid of as much risk as possible. It's easy to set a strike at 20% or 30% out of the money, pick a notional amount, and say, "I'm comfortable with the bulk of the risk. I just don't want the company to go out of business so I want protection. I want to cut off the tail." It's relatively simpler and a lot of times more efficient to do that with derivatives than any other way.

Finally, a carefully designed reinsurance program should leave you with a portion of the risk that is either profitable and you know is profitable or you expect to be profitable or easily managed with derivatives. Again, there are always ways to slice and dice it and you can try to cut it up and leave yourself with a piece that you like for one reason or another. You should determine which part of this risk you are comfortable with and then move all the other stuff outside of the risk that you want.

Mr. Lindner: I called the reinsured, the bank, our office in Europe and asked, how do I get rid of it in the best possible way?—with the stuff that you're going to keep? I think comes first and you have to decide what your goals are for the risk management. I'm going to pass it on to Lance who's going to finish up by getting into more detail on dynamic hedging.

Mr. Lance R. Berthiaume: A lot of my stuff may seem redundant with what Ari and George covered so I'll focus my presentation more on the dynamic hedging stuff. What I am going to try to do is give you what my view of the current market conditions are for VAs. I'll talk about embedded options and risk and then talk about the risk management options for our VAs. Then I'll try to provide a summary and then talk about maybe what the future holds.

Current market conditions. I think we've had tremendous growth in the products with equity market exposure. I believe that the 1990s might be termed the VA decade, but the other thing that we're seeing especially this year is volatile capital markets. I think people who have been paying either through the products they have or their own personal investments know over the last few months how volatile the capital markets can be. We see competition increasing with the dramatic growth with VAs. I think that's attracted new players. But, at the same time, with this increased competition, what we're seeing—if the profit margins are decreasing from this increased competition to maintain market share and something that's more of a recent phenomena in the last year or two—is limited availability of reinsurance coverage for VAs. I think the reinsurers are starting to get nervous. Recently the U.S. VA assets passed the \$1 trillion market. The baby boomers are probably still entering the wealth creation stage. We've seen double-digit growths of VAs in the 1990s and while this double-digit growth may not

continue indefinitely, even single-digit growth on \$1 trillion is extremely large. This \$1 trillion market creates a significant equity market exposure and it's increasing every day.

Just a short overview of some of the embedded options with equity exposure. Not all of these are VAs, but it does show you that the equity exposure on our products is increasing. We've got GMDBs, accumulation benefits, and income benefits. There are also equity-indexed annuities, equity-indexed GICs, and segregated funds, a Canadian product. What is the result of a market correction? In the short term, we have higher reserves, at least in the U.S. and now in Canada. You're going to have to throw up more reserves for your GMDB. I said GMDB, but the Society is now working on a reserve requirement for GMAB and GMIB.

Surrender charges. If your surrender charges are a percentage of your assets, then if the market corrects, you're going to have lower surrender charges and your reserve offset goes down. Some carriers may put up additional capital because they have higher reserves. The long-term effect, which is probably more devastating for a sustained correction, is lost revenue. Your mortality and expense charge is now going against a small base and the death benefits are going to start kicking in. You stay in correction and people will start dying. Now let's talk about the risk management options.

Here are some risk management options. The first one is to run the risk and that's when it's a reinsurer. You can have capital market solutions, dynamic hedging, product design alternatives, and combination approaches. One of the things I think we always have to be mindful of is we're in the risk-bearing business.

The goal is not to eliminate risk, but to manage risk. Are you trying to maximize the goals within certain tolerance and constraints? Especially when you get outside, more or less financial people, they want these products, but they don't want the risk associated with them. I don't think that's very realistic.

Run the risk. There are really two options here. You can either run it naked, don't do anything, for a small line of business; for a big corporation, that may be a very viable option. You may be willing to take the volatility that's going to exist when the market does correct. The other option is to hold the capital, but the question always comes out, how much capital? With too much allocated capital, the cost becomes excessive.

The key is always to understand your risk profile and what you're willing to live with. Reinsurance. What we're seeing in the market recently is limited availability of reinsurance coverage. The number of carriers is declining. There's no coverage or very limited coverage of the tails, and that's where most people want their coverage. Costs are increasing.

We're actually seeing some carriers that won't accept 40% or 50% of the people who ask for coverage. The costs are probably greater than we ever originally priced and in some situations, depending on the richness of the benefit, the cost may be

greater than any revenue or any profits you expect from your product, and for the remaining carriers, there's limited capacity.

They are willing to take on so much risk and one of the things that's kind of unique about this risk is that unlike mortality risk, this risk is not diversifiable, whereas, with mortality, not all the reinsurance clients are going to have bad mortality at the same time.

Unfortunately for an equity market correction, the correction will hit everybody at the same time to varying degrees. All of a sudden everybody is going to need coverage and, unfortunately, if everyone who is insuring has a large block of exposure, you could wipe out a reinsurer.

I think reinsurers have gotten nervous because some of them started going to capital markets to help them hedge their own risk and what they found was that the capital markets look at this and price this much differently than we do as actuaries. They do it on a risk neutral basis. We, as actuaries, don't price that way so I think that's one of the reasons reinsurers have gotten nervous. Capital market solutions essentially entails a long dated put option and the problem is you're going out seven or ten years. You need to be able to predict your experience and mortality and lapses and, if it deviates from what you assumed, this is going to create losses. So it's very difficult to go out that long and really have your assumptions hold for that long period of time because you have liquidity issues. Essentially since the market is providing you with liquidity, there's a large bid ask spread with this and then you have counter-party risk. Are they going to be there at seven or ten years when you need the coverage and you have basis risk? There's never a perfect match between an option and the funds that you have.

Now I am going to talk about dynamic hedging and about the steps involved in doing a dynamic hedging program. First, you need to determine your risk profile, which will help you understand the risk that you are actually taking on. The next thing that you need to do is actually model your liabilities, and probably the key assumptions on the liability side are lapse and mortality. Lapse is very key. Your hedging costs are very sensitive to your lapse assumption. On the asset side you need to have a spot curve, assume a certain volatility, and have a correlation of funds. The next thing you need to do once you've modeled your liabilities or developed your assumptions is to partition the liabilities and determine your hedge assets. What I mean by this is nobody's funds are all in equities or bonds; it's a combination, so you need to bundle your funds together so that you actually can go out and hedge. You want to bundle like funds together and this is a very critical step in the process. The next thing you would have to do is calculate the Greeks, and I think the Greeks are self-explanatory here. Most people delta-hedge, but having seen a lot of people gamma-hedging for interest rate exposure, you tend to watch gamma, but gamma-hedging can be very, very expensive. Probably the other key Greek is the rho because that's the sensitivity to the risk-free rate, and again, the capital markets price on a risk-free basis.

The next thing you'll need to do is to determine your initial hedge position. Once you've determined your initial hedge position, you'll have to execute your trades

and then on an ongoing basis, you're going to have to rebalance as necessary. Most companies like to look at this at least weekly to monitor daily and rebalance as necessary and to be able to rebalance on a daily or weekly basis requires that you have a fairly sizable block of business. On an ongoing basis, you're going to want to monitor your results and just see how well this dynamic hedging program is working. Actually, most people suggest when you first embark on a dynamic hedging program, you actually want to create a market portfolio for two or four months at a time to make sure that the program is going to work as you intended; this will also allow you to fine-tune the program. The other considerations with a dynamic hedging program are reserve volatility and accounting treatment. Most of what we've been talking about today is kind of economic exposure. I think most people believe that the long-term way to look at things is on an economic basis, but I think people are very sensitive to what hedging or dynamic hedging or what these benefits are going to do to your balance sheet and to your income statement and you can design these programs to actually hedge reserve volatility and accounting treatment.

The next thing to talk about is where the risk exists with a dynamic hedging program. Probably the key one, the first one, is your model risk. Here it's just incorrect assumptions, incorrect formulas, and just incorrect technique. I mean you're assuming a stochastic distribution; if that's wrong, your hedging program is going to be wrong. Basis risk. There are no perfect hedges out there for VAs and you're always going to have basis risk; it's just a question of how much basis risk that you're willing to live with and then trading risk. I think George and I alluded to this. You have to have expertise to do this. You are going to have to have people who know about options and the asset side of the balance sheet and can actually execute these trades and, as always, the risk that you just screw up the trade.

The next risk management option is the product design. Risk management really starts in the product design stage. I mean you really need to understand your risk exposures. You need to really start at the beginning. Given everything that's happened in the last couple of years and the perceived cost of these benefits, this may be the time you want to revisit your product design. You may want to eliminate options. You may want to eliminate types of benefits that are not perceived to be very valuable to your policyholders and then you really have to ask yourself about those benefits that the market is underpricing and whether you want to offer those in your products. Probably one of the biggest opportunities is in the corporate risk management with other liabilities; they may be natural hedges within your own portfolio. In your natural internal hedges, you may be able to go long on one product and short on another product and you won't have to go to the market and purchase those options.

The problem with trying to do the natural internal hedges is you have to come up with a complex risk transfer of pricing and that can be difficult. Probably the best solution is a combination strategy. You may want to reinsure where you find it attractive. No two actuaries and no two pricing people look at the risk entirely in the same way. You may look at the risk carved in a different way from your

reinsurer, and you probably want to reinsure where you do find it attractive. It's probably unlikely today given the cost and the reinsurance market.

Where you find your risk unacceptable, you may want to hedge and then you may want to run the risk for the remaining portion of the risk. Our view is that one strategy is probably not going to work over the long haul or even in the short run. The key to managing the risk is understanding your risk portfolio. I think that's the first step in any of this. The risk appetite is also important. I've actually heard clients say that to me. They really don't understand what their senior management appetite for risk is, and that's almost part of the equation.

You can do all the financial analysis you want, but if you don't know what your senior management is willing to accept, it makes it a difficult decision on what to hedge and what to control and then just the whole capital markets pricing. I think we as actuaries don't price the same way as the capital markets. You need to understand that disconnect and understand that if the capital markets are going to be part of your risk management option, you need to factor that into your pricing.

In summary, the exposures are increasing and current reinsurance options are limited. I think combination strategies may be the optimal approach to risk and VAs. I can't predict the future, but the thoughts I have on the future can be summed up in a question: Are we going to see a contraction or expansion of products with equity market exposure? My prediction is if we can't find reinsurance or other risk management tools to control the equity exposure we have in our products, we actually may see a contraction in the markets that offer these imbedded options.

What will reinsurance do? Will the increase in price in reinsurance attract other players? Who knows? Will the capital markets come up with a new, innovative way to deal with these types of risks? Probably in the end there will be just new, innovative products or pricing techniques. Thank you.

Mr. Lindner: All right. We have a little time left before everybody runs up to the front to ask questions.

Mr. Michael E. DuBois: I hope the answer to this is not a secret. I just wanted to compliment you on a very fine presentation. Two parts to this. In the first presentation there was a discussion of resets and proportional death benefits and other methods of trying to limit the risk through product design. How widespread is the use in the marketplace right now? Are the products that are selling the ones with these?

Secondly, Ari, you had mentioned the reverse GMDB which seems to be a product that gives you an offsetting liability. Are we seeing anything more on that front of getting liabilities that help offset some of these risks so that the package together is something that we can find some type of management tool to help us with the risk?

Mr. Lindner: I'll let George go first.

Mr. Christopher: With the first question, my work has been more with people who are not accepting these risks anymore, so I am not sure that I'm qualified to tell you exactly what is the most popular thing being written right now. We're working with people who were accepting the risk and have decided they have too much and won't take anymore and now they're asking, what do we do now?

Mr. Lindner: I've been working on this for four or five years. At the outset a lot of companies had non-proportional withdrawal benefits for the death benefit. That was a non-proportional reduction for the primary reason that they either hadn't thought of it or that their administrative system—whatever that was—couldn't handle it. It wasn't built to handle a proportional reduction of death benefit.

I would say that most products being written—I'm going to say 80%, but it's probably in that ballpark—have proportional reduction of the benefit, if it's a death benefit or something else, on partial withdrawals. The ones that are lagging are companies that are having problems with administration because everybody pretty much realizes now, if they didn't think of it themselves, a reinsurer has told them or a consultant or somebody has told them that that's a problem and it's an anti-selection problem so you have to deal with it. Getting the administration on the ball has been a struggle for some. Your other question about the reverse GMDBs, I think the answer will be it depends on the response of the ultimate risk bearer.

If your actuaries decide that you're getting a good offset from the death benefit that pays when the market goes up. It pays when the market goes down and, if you can, on an overall portfolio basis, come up with a better design or cheaper product or alternately if the reinsurer will give you a deal by covering both, whatever that ends up being, then I think you're going to see a lot of it. In either case, I think you're going to see more of it because I think it's an attractive benefit.

No marketer that I've talked to at the National Association of Variable Annuities meetings and things like that wants to sell their products saying all right you better buy this because the market could just tank tomorrow because our funds are terrible. Everybody wants to sell it as it's going through the roof—you better buy this because if you do die, then you know your spouse is going to owe a lot of taxes because it's going to do great.

So from a sales perspective it's better. You should bear in mind though that they don't offset exactly, especially with a ratcheting benefit; then you're exposed more when the market goes up for both types so think about it that way. It seems at the outset that they offset and they do a little, but in some cases they don't offset real well.

From the Floor: I was wondering if one of the speakers could comment on what impact FAS 133 will have on dynamic hedging, essentially the fair-value accounting rule that's going to be implemented at the end of the year. I also heard that New York has instituted some special requirements. There's some circular letter that's going on so I was wondering since none of you have commented on it in your

speeches, if one of you could talk about what you think the impact of this will be on dynamic hedging.

Mr. Berthiaume: I guess I'll take this one. I am not an FAS 133 expert, but my understanding is that a dynamic hedging program may not qualify under FAS 133 so you may have the volatility on your balance sheet or your income statement. Again, I'm not an expert but that's my understanding to date.

Mr. Lindner: My only prediction is that consultants will be getting work because I think that a lot of people are just starting to spend a lot of time thinking about this, but I am not an FAS 133 expert either.