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Variable Annuities and Segregated Funds—Guaranteed Benefits Valuation Issues

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Summary: Recently a significant amount of valuation activity has occurred in both the U.S. and Canada regarding guarantees on variable annuities and segregated funds. An American Academy of Actuaries work group has been addressing valuation issues regarding variable annuity guaranteed living benefits. Actuarial Guideline XXXIV was effective year-end 1998, addressing variable annuity minimum guaranteed death benefits. Additionally, a Canadian joint-working group of industry, professional, and regulatory members has been investigating the reserve requirements for segregated fund guarantees.

Panelists provide a brief description of the guaranteed benefits offered in both countries, followed by an in-depth comparison of current valuation issues, including risk assessment, reserving, and cash-flow testing.

Mr. Stephen J. Preston: I am the executive vice president and chief actuary for Golden American Life Insurance Company, an ING company. Our two speakers will compare U.S. variable annuities (VAs) and Canadian segregated fund products with the focus on valuation issues. Our first speaker, Jonathan Wooley, will focus on the U.S. side and Craig Fowler will talk about the Canadian side. They will begin their presentations with a brief discussion of the products that are currently offered in both countries and then focus on reserving methods in both countries. It is interesting to note that both countries have developed (or are developing) both an interim reserve solution and a long-term reserve solution. Then the speakers will discuss guaranteed benefit risk assessment and risk management techniques, followed by a discussion covering cash-flow testing and asset adequacy issues. Finally, the speakers will close with a brief discussion on solvency issues, such as risk-based-capital considerations.

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

Our first speaker, Jonathan Wooley, who will focus on the U.S. side, is corporate vice president and actuary for New York Life Insurance Company. In his 32 years with New York Life, he's been involved with virtually all actuarial aspects of life and annuity operations, including pricing, financial, and asset adequacy types of work. He's been very active in Academy work groups, including membership in the Academy's Variable Annuity Guaranteed Living Benefit (VAGLB) Work Group. He is also a member of the Academy's Committee on Life Insurance Financial Reporting, and in the past he has participated in other Academy and industry groups, including groups on nonforfeiture, disclosure, and annuity valuation. Thus he certainly is well qualified to discuss the topic at hand. He also has acted as associate editor of *The Actuary* and editor of various transactions.

Mr. Jonathan L. Wooley: The interim report of the VAGLB Work Group that the Academy has put together has much good reading. The work group issues reports to the Life and Health Actuarial Task Force (LHATF) of the NAIC. There is much good reading there. I think it's 50-odd pages, with lots of technical analysis, so if you want to get into the reserving issues, you can certainly do that.

As you probably all know, the benefits—certainly in the U.S. for death and the more recent living benefits—have been accelerating in their variety of designs. With that, let me get into the guaranteed benefit valuation issues in the U.S. market.

I'll quickly go through just a few definitions, as you may have seen these a few times before. The guaranteed minimum death benefit (GMDB), obviously, guarantees a minimum pay-out on death and was traditionally for many, many years just the return of premium. But now, in the last few years, the guaranteed amount can be the net contributions accumulated with or without interest, or the anniversary account value reset every one to three years. These are typically called roll-up benefits, wherein you accumulate interest, do not accumulate interest, or ratchet the benefits when you retrospectively look back every one to three years. They're offered with or without specific charge. Some companies have these as riders. Actually the riders are offered more with the living benefits, but I think some companies like to have a menu of death benefits that give the policyholder the option of paying extra for the more valuable benefit.

A variation of this has happened in recent years. It was the GMDB mutual fund wrapper. This benefit has been underwritten by a few insurers for a few mutual funds and they're similar benefits to what you would find in the VA contracts. From what I've seen—and again, it's a quickly moving market—they're offered at a specific additional charge of 20–30 basis points.

One of the more recent benefits is under the living benefit category, the guaranteed minimum accumulation benefit (GMAB). It provides returns of net contributions with or without interest, typically after 8–12 years, on some or all of the VA subaccounts, including the fixed account. We find that the most current ones are the roll-up benefits. We haven't seen a ratchet benefit yet on the accumulation side, but it may very well be coming. It's offered as a rider with a separate cost, of course, or integrated with the base policy, in which case there may or may not be a separate cost.

It's interesting that here the cost is much more variable, but it ranges from 50–150 basis points in the marketplace. I think some of the costs are related to the cost of hedging. Some companies are going with hedging and some are basically taking the risk on their own.

Regarding pricing, the guaranteed minimum income benefit (GMIB) provides for the application of a guaranteed accumulation amount to the guaranteed purchase rates in determining the periodic income. I think the key item here is that you are taking the accumulation-guaranteed amount and applying it to a relatively conservative-guaranteed purchase rate basis that is in the settlement options of the deferred annuity contract. The guaranteed accumulation amount may be the net contributions with interest, the maximum anniversary value, or some combination of the two. Because you have the interaction of the two elements, one being a conservative purchase rate, the cost is significantly lower than the accumulation benefit.

What we've seen is maybe a charge of 15–30, maybe 40, points. Very recently we've seen the guaranteed payout annuity floor (GPAF). The GPAF provides for guaranteed periodic income equal to some percentage of the initial payout. This information is probably outdated by now. It has been currently available for the Standard & Poor's (S&P) 500 portfolio only, but it's probably being offered to other portfolios or collections of portfolios as well. It is a fairly high cost benefit, with a 125–200 basis point charge against the contributions under the contract.

What I've seen is that the amount of the guarantee can run anywhere from maybe 80%, maybe even up to 100%, of the initial payout, and obviously the higher the percentage, the higher the overall cost. I think I've discussed this already—that these guaranteed benefits are constantly evolving in the types and the different designs. As a member of the VAGLB group, this continued innovation leads to difficulties in pricing, finding hedging strategies, and setting the reserving techniques, which is our specific focus.

In looking at the overall risk that both living and death benefits have, I think we can look at two major risks. I'm going to mention risk assessment in more general terms, and I think Craig is going to go into a little more depth in his presentation. The volatility risk is associated with short-term, sharp up-and-down movements in the various fund returns, whether it be something simple like money market returns or more complex like an international fund. The other major risk is the under-performance risk, which is more associated with the long-term variable fund returns; i.e., returning amounts below expectations. It's always very interesting that the more risky funds historically have higher returns, but with much higher volatility. So depending on which benefit you're talking about, one or the other benefit, or both, can be more significant.

For the death benefit risks, we feel that the short-term volatility risk is usually found to be more significant relative to the long-term performance risk. Obviously, death benefits are generally involuntary, and they happen relatively evenly over the course of the contract. The idea is that you have to worry about the short-term

fluctuations in the various markets that have the fund subaccounts. *Guideline XXXIV* (Steve and Tom Campbell co-chaired the task force that ultimately led to *Guideline XXXIV*) requires a single scenario stress test using immediate drops and subsequent recoveries to these fund returns in producing the commissioner's annuity reserve valuation method (CARVM) reserves.

Of course, all the reserves for both the living and death benefits have to be done in strict accordance with the CARVM, looking at the integration of all benefits. There's probably one difference from the reserving relative to the pricing. In pricing, you can put in assumptions as to lapse and annuitization rates. But CARVM requires that you have the greatest present value of future benefits, including 100% annuitization and surrender tests.

For the living benefits, we feel that it's the longer-term underperformance that is the most significant risk. The concept here is that most of the living benefits have waiting periods, whether they be the income benefit or the accumulation benefit, of anywhere from 8 to 12 or even a longer number of years. You have to worry about how the markets, or the sub-accounts, are going to perform over the long term. The committee's focus has tried to take the principles of *Guideline XXXIV* and adapt them to reflect this longer-term risk (as opposed to the work that was done in setting up the reserving methodologies for the death benefits).

Regarding the risk management techniques, reinsurance is one very possible avenue. What we've found both in the death-benefit arena, as the death benefits have become more valuable, and just beginning now with the living benefits, is that the reinsurance market is going through a transition. There are some new entrants and some new exits. I could probably keep saying that for months and quarters significantly into the future, because the reinsurers continue to approach the market with caution because of the complexity, variability, and variety of the various guaranteed-benefit risks. I think some reinsurers were so successful over the past several years as death benefits have increased in value that they found they had a tremendous amount of exposure on their books, much more quickly than they expected. These reinsurers are some of the ones that have exited the market, at least temporarily.

Another thing that can be done is hedging, because the guaranteed benefits act very similarly to derivative instruments. In this case, the living benefits, in particular, are like put options. You can do either partial or complete hedging through the purchase of customized or publicly traded puts. You can even use dynamic hedging by combining puts, calls, and futures and coming up with some sort of replication strategy. I think one of the biggest problems with hedging is that the particular design that companies are coming up with does not often fit what future contracts are out there. You may have an S&P 500 put, but is it one that is for the international fund? Probably not. For a combination of all the funds, it's very difficult to get a relatively direct match to the particular risk or contract that you actually have.

Then, of course, you can go naked. Some companies are willing to simply invest in bonds and have a willingness to self-insure, but only up to a certain sales level. I

think there are a lot of top management discussions going on wherein some top managers look to the historical risk, the historical experience, and say there's very little risk. They say, "Let's not even charge for this benefit. Let's take on the entire risk ourselves." Then, there are some actuaries who are familiar with stochastic testing, log normal distributions, and so on, who will say, "Well, there is the possibility of major catastrophe." You've got a wide variety of opinion in corporations. They usually protect themselves only up to a certain sales level.

In regard to the GMDB reserving, *Guideline XXXIV*, which was referenced earlier, was effective at the end of 1998. In conjunction with *Guideline XXX*, it raised awareness of the risks of multiple guarantees and options provided under the VA contracts. I think a lot of companies were caught a little bit short because they found out when they ran the numbers that their reserves for the VA contracts were significantly increased.

There are even some provisions within *Guideline XXXIV* under which you might even have a negative reinsurance reserve credit and it wouldn't just stop at a floor of zero credit. I think a lot of companies were just caught unaware by that.

I think the key element of *Guideline XXXIV*, aside from just measuring the risk, is that it provided for the integration of the death benefits with other benefits in the CARVM calculation, by combining three and actually even four different benefit streams. Stream A was the net amount at risk projected using the immediate drops and recoveries to the various fund returns and the amount of these guarantees that was paid to the expected deaths. Stream B was the stream of account values paid to expected deaths, and Stream C was the stream for all other benefits, other than the reinsurance.

The key thing here is that the actual account value on the valuation date was subject to an immediate assumed drop in value. Then, as soon as you had that immediate drop in value, the reduced account value was assumed to earn a recovery return each forward year. I think the guideline prescribed different unique drop and recovery amounts for five different fund classes. There were generic categories.

The VAGLB Work Group was formed, I think, in early 1998 at the request of the NAIC through the Academy. We've been addressing the valuation issues providing fairly comprehensive quarterly reports to the LHATF. I think we've given them a lot of material to read. Our focus has been on evaluating the risks of the various current benefit designs and trying to adapt *Guideline XXXIV* to the reserve determination of the different benefit designs. Again, the concept is of integrating this with all other benefits and trying to keep to the spirit of the CARVM methodology.

I think Steve touched on this—that our recommendations are really intended to be an interim reserving strategy. In fact, the Unified Valuation System (UVS) Group has formed a low-frequency high-cost benefit subgroup to evaluate the risks and recommend the long-term reserving solution consistent with the overall UVS methodology. As I have said, with benefits becoming more valuable as time goes

by, we may have to move away from the simplified methodologies. What we're looking at now and what we did leading up to the October interim report, as well as going forward, is the development of stochastically determined benchmark reserves for various accumulation benefit, income benefit, and guaranteed payout floors.

Looking at many decades of historical experience and different periods of historical experience, we are trying to come up with simplified reserve approaches consistent with CARVM, the benchmark reserves, and the integration concept of *Guideline XXXIV*. As we go forward, we're going to be looking at the accumulation benefit in conjunction with the death benefit, and then go on to the income benefit in combination with death benefits and see where it all takes us.

In summary, we're developing this VAGLB reserve recommendation based on the whole concept of the integrated CARVM structure of *Guideline XXXIV*. Right now we're looking at the fact that the VAGLB Work Group solved-for reserves will be the difference between the integrated reserves with the living benefits and the reserve held in absence of the living benefits. Again, I think this is somewhat similar to what was done in *Guideline XXXIV* with respect to the death benefits. As I said a few times before, our goal is a simplified approach with a single-scenario stress test similar to that described by *Guideline XXXIV* for death benefits.

Our current simplified method is called the keel method. I think Tim Hill of our group coined the word keel to represent the shape of the curve derived from the log normal distribution formulas that we used to basically project out the accumulated fund values using various assumptions. The curve actually drops below the starting point. The curve appears somewhat like the keel of a boat as it drops and then recovers as it traces the actual log normal formulas we used. Because it uses key assumptions in terms of the means of the distribution, the volatility of the distribution, and a particular percentile tail of the distribution, it does produce a standardized, simplified, and single-scenario stress test that is similar to the immediate drops and recovery returns used in *Guideline XXXIV*. But its very nature is that it reflects the long-term risks associated with the VAGLBs. As I said before, it's used to project the account values to determine the VAGLB cost.

We found that the keel method does work for the majority of the accumulation benefit designs. Most of those current designs are roll-up designs, where you take contributions accumulating with or without interest. We found that it does not work very well for the ratchet designs. Ratchet designs, by their very nature, are retrospective, and the forward log normal distribution doesn't fit that very well. Of course, future designs could be developed for which the keel would not be appropriate.

This, of course, gave us a dilemma. Maybe we could develop a modified keel approach that could address certain benefit designs, but even then there could be some new designs for which even the modified keel approach would not produce appropriate reserves. As another extension of this, multiple scenarios may be required to project a particular living benefit risk, and the CARVM reserve would

have to be based on the greatest present value of a pre-determined number of scenario risk results.

The other alternative is—again extending the concept a bit further—that we would rely on the valuation actuary, and *Guideline XXXIV* would describe less detail for the particular reserve methodology, but it could include some standard assumptions. Right now we're thinking that these alternative methods and extensions would work in conjunction with the keel method, because that does seem to work for the current roll-up benefits. We are definitely trying to keep to a simplified reserve method that does provide adequate reserves. As we go forward, we're going to have to look to the LHATF for guidance on the particular specific alternatives.

Let me just spend a couple of minutes on risk-based capital. The Academy's Life Risk-Based Capital Task Force made interim VAGLB RBC recommendations to the LHATF in June. The concept is that they were interim because the final recommendations will be dependent, of course, on the ultimate level of reserving. The key here is that the combination of reserves and RBC is what, I think, the regulators are most concerned about. There's probably a lot of discussion going on. Where is the appropriate dividing line? How much reserve versus how much RBC? Then, of course, the C3 risk to the insurer is that the assets that are held in support of the reserves plus the future fee income, if there is any, do not provide for the guaranteed benefits.

The interim requirements, which are to be effective at the end of this year, are, regardless of what you may otherwise be doing, a base 2% RBC factor that is applied to the total reserve for both the base and the VAGLB reserve; i.e., the total reserve for the VA contract. But a 1% factor may be used if the actuary submits an unqualified reserve adequacy opinion and if your fund balance is either not in the money or only a little bit in the money.

For the accumulation benefits, your fund balance cannot be in the money, nor can it be less than the guaranteed benefit on the valuation date. For the income benefits, they've allowed for some amount of being in the money to the tune of 20% to allow for the recognition that the accumulation amount is going to be purchasing benefits based on guaranteed purchase rates.

As just a brief note on cash-flow testing, I think everything I've mentioned up to this point bears on what you have to do for cash-flow and asset adequacy testing, in that the risk profiles—in particular, the death-benefit or living-benefit design—have to be captured in various stochastic fund scenarios that are consistent with the fixed-income scenarios evaluated. In other words, certainly there are the basic fixed-income-scenario tests that we have to do for evaluating all the C3 risk on the fixed-income benefits and fixed accounts. Your stochastic scenarios should be somewhat consistent with those tests.

Most important, it's up to the valuation actuary to decide which model aspects try to capture all the variations of the design and what may happen with fund performance as you go forward. The appropriate volatility risks and

underperformance risks should be measured through such stochastic scenarios. I'd say that in all the basic reserve testing we've done, we've done a tremendous amount of benchmark testing that has taken into account all the different types of volatilities of each of several different funds. We've tested as many as 12 different funds. We've done a tremendous amount of work in trying to evaluate the risks of these different funds.

In looking at the whole thing, we have to recognize that the death- and living-benefit designs are constantly changing and that a simplified standard reserve approach is going to be difficult. The keel method produces adequate reserves for many benefit designs, but we're going to have to come up with other complex reserving methods to cover the current ratchet designs, as well as future designs that are probably in somebody's dream right now as we speak.

It's a constantly evolving market in the U.S., for which we are trying to establish reserve recommendations to the NAIC so that they can be comfortable and, by default, so that company management and actuaries can be comfortable that we do have adequate reserves for these benefits.

Mr. Craig Fowler: I'm going to talk about Canadian segregated funds and hopefully give you an overview of the products that are in Canada, their characteristics, what work has been done to date, and what the future direction is in Canada for these products. I hope you will get the idea that there are a lot of similarities between the Canadian and U.S. products. There are a couple of small differences, but really the basic intent of the products is very similar. There are some things that we can work on together to come to a common view of how to view these risks and how to reserve for these risks. As Steve mentioned, that was part of the purpose of the symposium we had in Toronto last month.

I'm going to walk through a bit of a description of Canadian products. There are some differences, some different terminology, and some different reasons for why benefits are different in Canada. I hope I can give you a bit of an overview of that. I will also discuss the specific risks of the products, which risks are different than the U.S. products, and which are the same. Jonathan gave a bit of an overview of the risk management issues, and I will go into a bit more detail on the risk management pieces, but not a full presentation on that by any means. You can definitely give quite a few presentations just on that topic alone. I will then discuss what's been done in Canada on the valuation side—where the current reserving and capital levels are in Canada. I will then give an overview on toward what things are moving in the Canadian market for the segregated funds.

The maturity guarantees in Canada are either 100% or 75%. Back in the 1970s the Ontario Securities Commission (OSC) said that if a life insurance company were to sell products that had a life guarantee and if it had at least a 75% guarantee, then it would not fall under securities regulation. The life insurers didn't do a lot of this type of product back then, but the guarantees and segregated funds in general became bigger a couple of years ago. Companies then latched onto that 75% so it didn't have to be regulated by the OSC. At this point in time there was a good mix of people who were offering a 75% guarantee on the accumulation-type benefits

and a 100% guarantee. Obviously, a 75% guarantee is a less punitive option to the life company, so it provides you some freedom in offering the clients and customers a product that still has a guarantee but is not potentially as risky, or costly, as a 100% guarantee. By law within Canada, for an individual product you have to give a 100% guarantee upon death. The individual products that have been sold in Canada need that guarantee on the segregated funds. Other than that, the death guarantees tend to be a lot more basic than the U.S. guarantees.

The options and things like that are not as prevalent in the Canadian market. The death benefits are not as generous as they are in the U.S. The Canadian retirement market is split very much in the accumulation and through the payout phase with the 401(k)-type benefits in Canada. Therefore, there are companies that are just offering these types of benefits for the people in the accumulation phase and have chosen not to do so, or have really watered down the benefits, in the retirement phase.

The definition or the type of guarantees can either be deposit or policy-based. The deposit guarantees tend to be less risky. For every dollar you put in, you have a ten-year guarantee on return of premiums on that.

When the Canadian companies were developing their products, they really looked to some of the examples in the U.K. in the 1970s, where some of the U.K. life companies were offering the policy-type guarantee. People were putting in a few dollars, and then 9.5 years into the guarantee, they put a wad of money in the fund and in essence ended up having this very short-term put option that the life company had given them. That caused a lot of problems in the U.K. and, I think, was one of the main drivers for the U.K. life companies getting out of this market in the 1970s, when they began to realize how expensive this was and what a generous benefit this was that they were offering.

The guarantee is also split between a fund-by-fund versus a family-of-funds guarantee. What that means is that for a fund-by-fund guarantee, if you put a dollar into an equity fund, then that dollar is guaranteed in an equity fund. If you do a family of funds, you're really looking at the whole portfolio the client has with you. If the client has money in an equity, money-market, and bond fund, then you're offering a guarantee on all of those. That tends to be less risky, because you have some diversification between the different funds that the person is investing in.

The maturity benefits are more where the Canadian companies have been offering these types of benefits. It's typically a ten-year benefit. Resets are something that the Canadian companies offer, and they are much more generous in comparison with U.S. companies. They allow you to reset your guarantee one to five times a year. I'll get into that a little bit more later, talking about some of the risk management differences, but that's another material difference between the two products.

Another characteristic is whether, when you switch funds, your guarantee has reset or not. If the guarantee does reset, in essence, as a person moves from an equity

fund to a bond fund, it's a lapse. Therefore, it's a good thing for the life company and a bad thing for the customer. In total, there tends to be a wide variety of options that are offered in the Canadian market.

As I was saying earlier, most of the risks are very similar to the U.S. products. The return of the market is a major risk. If the equity market keeps going on at 20–25% a year, these products have no risk. It's a nice "free fee" you're going to get, but obviously there's a risk there. Even though it kind of goes against the whole idea of offering a mutual fund, segregated fund, or variable annuity to somebody, this is a lapse-supported type of a product, where the more lapses you have, the fewer guarantees are going to be in place when they come to maturity or death. The lapse component and partial withdrawal piece of that is a very material piece of the risk.

You have, as is normal for reinsurance, counterparty risk. Also, if you enter into the derivative market, you need to ensure that the person you're hedging the risk with—the reinsurer or a derivatives party—is going to be there to pay off that benefit when you need it, so there's that kind of counter-party risk.

Some of the risks are a bit more unique to the Canadian market. One of these, as I mentioned earlier, is the reset option. This is a very complex option, very much driven by the policy-holder. If you don't have a reset option and the market is ever-increasing, as we've seen, then the option is becoming worth less and less, because there is less chance of the market ending up below the spot where it started. With this reset option, you're allowing the client, one to five times a year, to say, "Well, the market's up; I'm going to reset my option now instead of the \$1,000 I put in. I'm now going to reset my option at \$1,200, and therefore, it's adding to the value of that option." This makes it much more difficult to hedge and much more costly to the life insurance company. When these products first came out in a strong effort three or four years ago, the reset option was very generous. Five times a year was the norm. It's now being pulled back for the most part, companies are offering only one to two resets per year, which is a much more prudent stance. It's something that for the most part you can't do without; you can't ignore it in the Canadian market, because the competitors are all offering that feature.

On the maturity risk, the Canadian product has tended to emphasize more the accumulation benefit-type product, a ten-year type of guarantee. The death guarantee was there—100% return on death—but that was more of an aside. It was really the accumulation benefit guarantee that got more of the focus. The death-benefit risk is less risky for the most part in comparison with the U.S. products. There are some companies now offering the greater of 6% or the actual fund accumulation maxing out at 200% of initial deposit in Canada, but it doesn't tend to be as mainstream as it is in the U.S. market.

Basis risk is something that is a bit different in Canada than in the U.S., and it's a risk of which you need to be aware. It's unique, but it's also similar to the U.S. market. The managers with whom you are putting your money are trying to outperform an index. Any time they're not replicating an index, the hedges you are

trying to do are not going to perfectly offset that particular strategy that that fund manager is performing. In Canada, because the stock market and the bond market are not as deep and as liquid as the U.S. markets, there tends to be a bit more basis risk. Trying to replicate the underlying index tends to become a bit more difficult. It's a very similar risk to the U.S. market. It's something you need to be aware of; there's just a little bit of a difference because of the sizes of the two markets.

Jonathan touched on the risk management issues in his presentation. A paper that was written in the summer of 1998 by members of the CIA Investment Process Committee went into some detail on the three options for managing this risk. Hedging is a bit of a stronger word when considering that the first option is doing nothing. But that was the view of a lot of companies when this product was first being discussed a few years ago. You didn't need to do anything to hedge this risk. You look back at ten-year returns and the equity markets, and for the most part you don't see any time when the market was below zero after ten years, so why worry about it? It's a nice source of fee income; it's great to offer, because clients like it and we can make some extra money on it with no or little risk.

That viewpoint is definitely changing. That was one of the thoughts when these products were first being marketed a few years ago. The question at the end is somewhat rhetorical. Is doing nothing a realistic option? I don't think it is, but some people have thought that in the past.

If you're trying to hedge the risk and are leaving reinsurance as an aside, there are three possibilities on hedging the risk. One of the things you can do is go out and buy longer-term put options in the capital markets. As Jonathan mentioned, these products are becoming more complex. There are no simple instruments you can buy that directly offset this risk in the capital markets, but you can buy longer-term put options, ten-year put options, on the equity market and get a fairly good hedge in comparison with a lot of the products that are offered in the market.

Now, if you do go to the capital markets and try to buy these hedges, the components of the pricing tend to be quite high in comparison with where the markets have been historically. The dealer is going to price them using a mid-20%-type volatility and a risk-free interest rate. The dealer is not using a historical equity return. These two pieces, without getting into a lot of details, very much drive up the cost of those put options. You can't do much about the basis risk if you're just buying these put options in the market. That's just something you need to live with. The other down-side to buying these put options is that if you buy a ten-year put option based on the money you get in this year, and two years from now you realize your assumption was off quite a bit and you should really be selling some of those options back to the market, you're going to pay a large bid-ask spread to unwind that option. They're not common options—they're not that mainstream—so you're in a way stuck with issues that are very similar to those you have with equity-indexed annuity products. You're stuck with a longer-term option that is not very marketable.

Another method of hedging the risk is to delta hedge the risk. This is very similar in the fixed-income world to duration matching the portfolio. You're trying to ensure that you have a portfolio that basically replicates the underlying option that you've given to the client, and you're continually rebalancing that portfolio to ensure a duration match. When you're doing this, you're not capturing the convexity or the gamma risk of the option. With these longer-term put options that is a very material piece.

Again, it's not perfect, but you may be able to do it a bit more cheaply than buying the put from the capital markets. This takes a bit more expertise than calling up a dealer, obviously, and just buying a put option.

Another method of hedging the risk is kind of taking the delta hedge one step forward: dynamic hedging, or really trying to replicate and match the duration, the convexity, and the other risks that are inherent in these products. It involves a combination of shorting equities, shorting equity futures, and buying and selling more liquid options and also fixed-income securities. This is, again, one step past the delta hedging. It's more complex, but if your models are good and you have the expertise to do this, it's a better match of the risk than the delta hedge.

The other method that was discussed in this Investment Process Committee paper was reinsurance. Within the reinsurance market, assuming you can find a reinsurer to offer you this protection at an acceptable price, you can lay off the death-benefit type of component and the lapse type of component and have the reinsurer take on that whole risk. It can be much more encompassing going to the reinsurance market than going to the capital markets.

The difficulty here, as Jonathan mentioned, is that the reinsurers have been somewhat pulling back. Some were in the market and have pulled out, and some who had lower pricing have jacked their pricing up considerably. Therefore, if you put into place a VA or segregated fund program and start to bring dollars in, is the reinsurance going to be there at a price that you can really afford and still make a few bucks on these products?

I'm going to step back a little bit and kind of build up to the Canadian reserving methodologies that are out right now. One of the first, more public items produced on the segregated funds in Canada was the paper by Phelim Boyle and Mary Hardy back in 1996. Both are professors at the University of Waterloo with a lot of experience with actuarial and risk management types of issues. There was then also a paper produced by the practice committee in the summer of 1998, talking about the hedging. There was specific reserving guidance given for the end of 1998, and I'll get into more details on that in a second. There was the symposium that was sponsored by the CIA, the SOA, and the Actuarial Foundation in Toronto.

The paper by Boyle and Hardy was commissioned by Standard Life Assurance Company, one of the first companies that was offering this product in the market. The overall paper was about 90 pages. It gives an excellent overview of the products. The risks and sensitivity-type testing on the risks built up a nice

stochastic model to price and hedge this risk, and the paper really covers the full gamut of reserving and buying options.

Then there was the research paper last summer by the Committee on Investment Practice that discussed the risks and the products, as well as how to measure and manage the risks. The paper also looked at reserving and capital outside of Canada, what was being done in the U.S. on the GMDBs, and what had been done in the U.K. back in the 1970s with the products they were offering. It started to discuss the reserving, capital concepts, ways you should be setting reserves, what sort of percentile, and where capital should be set above and beyond that. It was a good overall paper on some of the history and also in setting out some directional items for the Canadians.

For the reserve methodology that was set up for the year-end 1998, one of the biggest debates and concerns was whether you do a deterministic or stochastic type of scenario. As Steve mentioned, a lot of the reserving in Canada and the U.S. is on more of an interim basis. We're trying to get something out there for people who have set aside reserves, realizing their methods are not perfect, but wanting to get it pretty close and expecting to improve on it later. Really, it ended up becoming a trade-off of the ease of setting up deterministic scenarios versus figuring out how to define stochastic scenarios for different companies. What are the inputs and factors when you're using a log normal type of distribution? What is the mean, and what is the volatility? Those sorts of items made it quite difficult, so the conclusion was to use the deterministic scenarios for the end of 1998.

One of the things we were trying to get out of the symposium in Toronto was a consensus on how to do stochastic-type reserves. We ended up with 22–23 papers submitted by a variety of practitioners and academics within North America on why their method was a good method to use and what the pros and cons were of the different methods. We didn't come to a consensus and an ultimate conclusion on what the right way to do things was, but I think it generated a fair bit of good discussion, and that will be built upon in the year 2000 to come up with, hopefully, more stochastic scenarios for year 2000 reserving.

The reserving standards that were set up were similar to the GMDB in the U.S. as far as, based on the different fund characteristics, we have a different immediate drop and then a return assumption to that going forward (Table 1). For the fund characteristics, what I'm really talking about is the volatility of the fund that you're looking at. Is it similar to a money market fund? The next level is between a money market and a bond fund, and you kind of carry your way down into riskier funds. The annual returns you're projecting forward are before your management fees and management expense ratio. In the case of the equity fund, you project an immediate drop of 30% and then an annual return of about 5.75%.

TABLE 1
DETERMINISTIC INVESTMENT ASSUMPTIONS

Fund Characteristics	Immediate Drop	Gross Annual Return
Money market	2%	2%
Between money market and bond	15	3.5
Bond fund	20	4
Between bond and stock	25	5
Diversified equity	30	5.75
Volatility greater than TSE	35	6.5
Riskier funds	40	7
Examples of riskier funds are emerging market funds, section funds, etc.		
All returns are before management expense ratios (management fees)		

Within the Canadian market, the charges and expenses tend to be much higher, so you're projecting a gross return of 5.75%, but net of fees it's probably more like 3%. These are fairly punitive to setting up your reserves when you take out the management fees, as you should be doing. To do the deterministic reserving, you're projecting for the possibles with and without the guarantees. To calculate your reserves, you do present values, the premiums you're going to get in on the risk charges, and net of the expense ratio fees, but more the separate risk charge—50–100 basis points you're charging for the risk of these products. That does offset your reserve. The one very material piece that's different from the U.S. market is that in Canada, the actuaries tend to have more room to make up their own assumptions and to use their own historical methodologies, but they are allowed to assume lapses of 5% a year when they're setting reserves on these products. This type of a guarantee—and it is really, in essence, lapse supportive—can bring your reserves down materially.

The Canadian companies were also strongly encouraged to do stochastic reserving and to take the higher of the two reserves (the stochastic and the deterministic). Within the stochastic-type reserves, it was really left to the appointed actuary's judgment as far as how he or she wanted to set the assumptions on different funds and items like that. Again, it was a step toward where we want to get in the year 2000: doing more of a stochastic look at these reserves.

I'm going to just touch on capital or solvency. This is a product that has a low-probability, high-severity type of risk. It's very much like a catastrophic type of risk, where, for the most part, you're not going to get hit with any losses, but from time to time—especially if you look back at the Japanese Nikkei market in the 1980s—you're going to get hit with a huge loss on offering these guarantees. Within the Canadian capital requirements, there is nothing required to date in setting aside capital. This is something that, it is hoped, will be addressed for year-

end 1999. However, there are no capital requirements here yet in Canada. That is a material issue.

I've put together a very simple example. There are no numbers, so I can't be checked on whether I did this correctly or incorrectly, it's more just a concept. Say you set aside a reserve based on Canadian methods right now (the deterministic methods), and that reserve was 15%. If you were to look at the 80th percentile of a stochastic reserve similar to what Jonathan pointed out in the keel method, trying to see what percentile you were covering, that might be more like 5%. Then, if you go to the 99th percentile, which is probably a good area to be looking at to be setting aside capital, the number increases tremendously from your reserve, from your 80th percentile; it's probably more like two or three times what your reserve is. This definitely needs to be reflected in the overall picture of these products, because the reserving is not necessarily going to be adequate enough. You need to have the capital set aside for that catastrophic 1-in-100 event that could be occurring right now as we watch the Dow come down from 11,000 to 10,000. It's something that we need to have stronger standards on and need to have capital set aside for.

The feedback that was received from the Canadian companies doing the 1998 reserving was four main items that they pointed out or commented on. First, the bond scenario was unrealistic. That was a 20% drop in the bond market and, I think, a 4% gross recovery. That's something that will probably be changed somewhat for this year-end, possibly trying to build in more of the durations of the bond funds, and possibly some of the credit risk components of bond funds. If you're investing all in Treasuries versus a high-yield bond fund, obviously there's a different risk level between those two.

Another comment was that the reserves are volatile based on where the fund was at valuation. It's being discussed, along with whether you should take the average of the last six months where the fund was for your year-end deterministic scenarios. I personally don't necessarily agree with that as much. I think this benefit is very much driven by where the current market is. If you're looking at a capital markets method of replicating, the value of this put option is very much driven by where the fund is. If the fund has come down 10% in the last month of the year, your reserves should be based upon that. Naturally, they're talking about change not just for the deterministic scenarios; the stochastic methodology will still be based on where the fund was at the end of the year.

Another comment—and this is where the difference between the Canadian and the U.S. product comes through a little bit more—is that the reserving overstates the cost of mortality guarantee. Keep in mind that more of the Canadian products tend to be the accumulation benefit, ten-year type benefits. This is not as big an issue in the Canadian market. However, if the reserving component were changed to allow actuaries to do that after ten years instead of using these gross annual returns that are somewhat conservative based on historical returns, the actuaries could move more to a higher return, a historical return, to set reserves and therefore mitigate the death guarantee somewhat, as it tends to be 20–30 years out in time.

The last comment came from the life companies that had done reserving at the end of 1998. The deterministic scenario overstates the reserve if the time for the guarantee is short. If you only have one year left until the guarantee kicks in and you have a 30% drop with a 6% recovery, obviously, you're going to have a very large reserve on that. Again, this comment is not as relevant, because if you were looking at capital market-type pricing, a one-year put option in annual basis points would be much more expensive than a ten-year put option.

Based on the feedback from the life companies on those four main items, there will be some changes in the deterministic scenarios for the end of this year. Those are usually sent out to the appointed actuaries sometime in November, so they aren't actually finalized yet. Hopefully, there will be more of a stochastic methodology in 2000, and the capital issues (minimum continuing capital and surplus requirements) will then be addressed to satisfy capital for this product.

Mr. Allan W. Ryan: Steve, I just had a real-life example of a Canadian company selling a lot of business in the U.S.—VA business, where *Guideline XXXIV* produces an additional reserve. The current, or I guess you'd call it interim, Canadian guidance for Canadian financial reporting produced a reserve about ten times as great. They may be in sort of a unique situation, but somebody appears to be wrong, if there's that big a difference. Are there any comments, especially from the Canadian side, on this question?

Mr. Fowler: Does the product provide more of the ratchet-type guarantees on the death benefit?

Mr. Ryan: I think they're of the fairly standard type, but I don't have the details right in front of me now.

Mr. Fowler: I guess I'm not particularly surprised at that. Maybe the magnitude is a little surprising. However, if you compare the drops and returns for the Canadian approach, they're much more significant than the U.S. drops, so I think that's probably the driver of the differential.

Mr. Wooley: Slower recovery in Canada may be a driver, as well.

Mr. Preston: The second difference is that for the Canadian method, the extra reserve held for the guarantee is determined on a stand-alone basis, whereas the U.S. method is a fully integrated CARVM approach, so the reserve is highly dependent on the base contract you're attaching the benefit to. In fact, some types of base contracts could produce no death-benefit reserves, while a fairly large death-benefit reserve could emerge for others.

Mr. Ryan: I guess that's still a significant difference. If you look at the economics of it, you have to wonder what's the right answer (if there is a right answer).

Mr. Wooley: I guess, by definition, the right answer is whatever happens in the marketplace in the next 20 years. The end result will be that no one has the right estimate.

Mr. Robert J. Johansen: I'm Chair of the SOA Task Force on Mortality Guarantees in Variable Products. You may recall that we, among other things, established a 1994 minimum guaranteed death benefit (MGDB) valuation mortality table, and we conducted a mortality study to see whether that table was adequate.

Unfortunately, our final mortality study included only nine companies, with eight companies contributing to the VA part and eight companies contributing to the fixed side, which we did as a sort of check on the variable. The annuities in question in both studies were during the accumulation period, prior to annuitization. I think that this is the first-ever intercompany study of annuities during that period. The 1994 table, which is essentially for death benefits, was found to be totally adequate. We also did the study comparing it with the Annuity 2000 table, and I wish I could say the same.

I can't say too much, because we did the study. I wrote a report last March, and after having written the report, I thought that the tabulations were perhaps hiding some of the characteristics, so we re-did the tabulations. I have not yet rewritten the report, but it should be available as soon as possible. It's being written as a paper rather than a report, because with the small number of companies there are, it requires quite a bit of opinion rather than the very factual approach of a report. But I thought you should be aware that there are a couple of things in the study that are a bit surprising.

You would not expect, for example, that the first year of mortality would show selection in the accumulation phase, but it does. There are a few other things that are rather odd about it, but the problem is that with only eight companies, you can't really be sure if this is characteristic of the business or if it is a characteristic of the particular companies. It's a paper that I think may be controversial, and we'll see what comes up.

TABLE 1

United HealthCare of the Midwest, Inc.													
Pharmacy Utilization													
Fill Date : Between '1998-01-01' and '1998-06-30'													
Paid Date : Between '1998-01-01' and '1998-06-30'													
Product: COMMERCIAL				Rankings: Number of Members				4	of		1596		
Specialty: 00 Internal Medicine				Expense per Member				548	of		1596		
Provider #:				Nbr of Rxs per Member				380	of		1596		
Address:				Average patient age: 45.9				Total Rx Cost		7	of		1596
				Percent Males: 53.6%				Total Rxs		2	of		1596
	Nbr of Members	Scripts Filled	Avg # of Rx/Member	Ingredient Cost	Avg Rx Cost	Avg Cost/Member	Generic Drugs	Dispense as Written	Formulary Compliance				
Total for Physician:	670	6000	8.96	\$172,961.44	\$28.83	\$258.15	81.7%	2.4%	87.3%				
Avg for providers:	73	555	7.62	\$18,336.78	\$33.03	\$251.72	75.2%	3.0%	91.3%				
MOST COSTLY DRUGS						MOST FREQUENTLY PRESCRIBED DRUGS							
Provider: AD12345 Doe, M.D., John			Specialty: Internal Medicine			Provider: AD12345 Doe, M.D., John			Specialty: Internal Medicine				
Rank	Drug Name	% of Total	Avg Cost per Rx	Rank	% of Total	Avg Cost per Rx	Rank	Drug Name	% of Total	Avg Cost per Rx	Rank	% of Total	Avg Cost per Rx
1	PROZAC	6.9	100.54	4	4.0	83.81	1	NAPROXEN	3.1	12.12	60	1.0	11.76
2	PRAVACHOL	5.5	65.27	2	4.5	65.17	2	GUAIFENESIN	3.0	6.47	236	0.3	6.08
3	ZOCOR	3.9	77.66	12	1.4	79.09	3	ATENOLOL	2.8	5.07	87	1.8	3.97
4	ZOLOFT	2.6	62.45	18	1.0	56.09	4	TRIMOX	2.7	7.4	71	1.5	6.42
5	PEPCID	2.3	73.79	39	0.5	81.92	5	PRAVACHOL	2.4	65.27	2	2.3	65.17
6	ACCUPRIL	2.0	27.50	20	1.0	28.85	6	PREMARIN	2.2	13.39	226	1.8	14.61
7	CLARITIN	2.0	55.95	5	2.9	53.77	7	ACCUPRIL	2.1	27.50	20	1.1	28.85
8	VASERETIC	1.9	49.73	231	0.1	37.11	8	SULINDAC	2.1	19.20	173	0.2	17.68
9	LIPITOR	1.8	49.59	3	4.0	59.00	9	NADOLOL	2.0	25.48	109	0.2	23.85
10	PREVACID	1.8	101.62	1	5.1	95.51	10	PROZAC	2.0	100.54	4	1.6	83.81
11	NADOLOL	1.8	25.48	109	0.2	23.85	11	HYDROCHLOROTHIAZIDE	1.9	2.75	190	1.1	2.38
12	VIAGRA	1.8	56.13	55	0.4	54.62	12	GLYBURIDE	1.7	18.16	49	0.8	18.46
13	BIAXIN	1.7	61.48	14	1.2	57.79	13	ZOCOR	1.5	77.66	12	0.6	79.09
14	IMITREX	1.7	96.06	7	2.2	113.49	14	VERAPAMIL	1.4	16.78	47	1.0	13.65
15	PAXIL	1.7	59.88	8	2.1	58.87	15	CYCLOBENZAPRINE	1.3	8.86	131	0.5	8.26
Totals		39.4		30.6			32.3			15.8			