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Using Reinsurance to Manage Guaranteed Minimum Death Benefits, Income Benefits, and Maturity Benefits on Variable Annuities

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Summary: Guaranteed minimum death benefits, income benefits, and maturity benefits attached to variable annuities and segregated funds have taken the U.S. and Canadian markets by storm. Products in Canada and the U.S. have different characteristics, but many similarities. In nearly all cases, the risk profile is one of low frequency and high severity. In the past year, both the American Academy of Actuaries and the Canadian Institute of Actuaries have released proposals describing reserving and capital requirements for these benefits. Panelists address the requirements and the ramifications of the new standards, plus possible ways to assess and reduce the economic risk, reserves, and capital requirements.

Mr. Timothy J. Ruark: I would like to lay the foundation for some of the designs of the guarantees in variable annuities (VAs). I then will discuss the recent Academy work on living benefits so you will have a working knowledge of where that is headed. Last, I will discuss the reinsurance market, and some of the recent developments.

Guaranteed benefits start with ratchets and rollups. Whether you're talking about death benefits or living benefits, this is fundamental. There are different ways to look at these, but we are not going to go into all of them. A ratchet ensures that the guaranteed benefit is never larger than the account value once was. From a risk taker's standpoint, you know that at one point the account value equaled the

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

guarantee. A rollup, on the other hand, can run away from you. After issue, the rollups move independently from the account value, so there's no reason to believe that the rollup amount of a guaranteed benefit has to be equal to, or once was equal to, an account value. This is a very simple and very important assessment of ratchets and rollups.

Note that a 5% rollup is net, and achieving a 5% rollup in your account value requires a gross return of 7–8%, because you have to cover the expenses in your product. Since most of the living benefits have an extra charge, it also has to be added on to your expense levels. Your 7–8% gross can quickly become an 8–9% gross. These expenses become significant hurdles for rollup business. It doesn't sound like much to say 5% per year, but it sounds like a lot more to say 8%.

For death benefits, claims can occur at any time because people can die at any time. If their benefit is in the money, then a claim can occur at any time. Mortality is important in death benefits, and surprisingly, people often lose sight of that. With mortality, you need to think about antiselection. It's nice to use a table that you're comfortable with and not feel you have to load it for antiselection. Often that's the case with death benefits, but there certainly are circumstances where it is not. Mortality improvement is also important. These are long-term benefits, and we know that improvement can have a material impact in the long run. However, I do not think that many risk takers price with improvement factors in mind. But it's one of those things that risk takers have in their back pocket, making you more comfortable with the risk.

Patterns by age or sex are very important for the guaranteed minimum death benefit (GMDB). The demographics, the fund allocation, where people invest, risky funds, less risky funds, and the experience that they have with withdrawing, are all very important for the death benefit, and they're important throughout the valuation period because claims can occur at any time.

Generally, for the guaranteed minimum accumulation benefit (GMAB), the claim occurs after a waiting period, unlike for death benefits. A key question is, where will your account value be at the end of the waiting period? Terminations, though, are still very important. Here it really doesn't make a huge difference whether a termination is a full lapse, a partial lapse, or a death. All that matters is that an owner was paying you premium for the benefit and left the in-force group before the benefit came due. The fund allocation is also important. There are not too many GMABs in the market right now, but the market developed in line with the equity-indexed market. There is a tendency to think that the GMAB can only apply to certain funds that you can buy derivatives on, but there are products with few fund restrictions.

The guaranteed minimum income benefit (GMIB) is much more complex. Claims still occur after a waiting period but, unlike the GMAB, where a 10-year wait means the claims occur at 10 years, here all you know is that they will not occur during the waiting period. However, the claim can occur after the waiting period, and for some products, many years after. Annuitization frequency adds to the complexity. If the industry felt confident that there would only be 5% or less annuitization each year after the waiting period, I don't think we'd have all the attention paid to GMIB that we do. Generally, the pricing would probably work out for the risk taker if he or she knew that just 5% of the people were going to annuitize each year, but no one knows that. In theory, all contracts could annuitize during the year after the waiting period is over.

Terminations are still very important for the GMIB, not just during the waiting period but also after the waiting period expires. For fund allocations, these products generally allow you to invest in almost everything that's available for the basic variable annuity, so, it's not as restrictive as, perhaps, a GMAB. But I've skipped the winner—interest rates. For these products, interest rates are hugely important. As a risk taker, I know that I would not price assuming that if the stock market did poorly, it would be because interest rates rose. High future interest rates can create a huge margin in this business. If you write this business today and, at the end of the waiting period, interest rates are 300–400 basis points higher than today, you almost have no concern about where the account value is.

But would you price it that way? I don't think most actuaries would, so this is more of a back pocket item. A risk taker is going to look at this and say, "I'm going to price assuming that interest rates do something in between staying where they are and dropping, but I do know that this is probably conservative." There is a probability that if the stock market performs poorly, it is due to high interest rates, and that will be a good thing.

Reinsure Versus Hedge

You need to decide up front on this important issue because your choice of financial management affects your design. This is especially true for living benefits. If you're going to hedge, ratchets are very difficult to deal with. If you hedge, you also need to penalize people for withdrawing early. Your real problem, as many of you know, is if you buy a long put option to protect yourself and the stock market does well, your put option is close to worthless. If people terminate at that point, you don't really have anything to sell to recover.

Here is the key. If you reinsure and don't purchase a derivative, you are involved in a catastrophic risk, and that's OK. People do catastrophic risks. It's OK to do that, but acknowledge that that is what you're involved in. If you purchase a derivative,

you change the nature of the game. It's no longer catastrophic. You paid all the money up front to buy the derivative. Now the risk is whether you can collect enough money to pay for the derivative that you purchased. If you have a situation where you buy a put and it's worthless, and people decide that the benefit is worthless and terminate early, what happens? It's not catastrophic, but it isn't very good either. It means that you are not going to be able to pay for the derivative that you purchased.

You also need to restrict transfers if you're hedging. Generally, you need to be more restrictive because your put is based on the S&P 500. Sometimes it is safer to restrict transfers. Retaining or reinsuring is definitely more flexible than hedging, but the risk remains a catastrophic risk, and that creates a whole different set of problems.

I want to discuss where the Academy is on living benefits. A task force has been meeting, and the next report is due to the NAIC in June. The Academy is focusing on a Guideline 34 approach that uses artificial drops and recoveries to create future exposures. It also is deterministic, so it's more simple than stochastic modeling. It integrates with the Commissioners Annuity Reserve Valuation Method (CARVM).

For Guideline 34, we found that evaluating this risk was much more important in the short run. In the long run, the contract's mortality & expense (M&E) fees become very large relative to benefit cost. This creates plenty of margin in the later years to cover death benefits. With living benefits, we knew early on that those same drops and recoveries for Guideline 34 cannot be used for living benefits. Under Guideline 34 a typical recovery for a variable annuity after an immediate drop is about 10%. That means, if you go out 10–15 years from now, that first-year drop isn't that important. All you really have is a bunch of 10% returns compounded on one another. That doesn't create much exposure for this type of business. That is one of the key items that has to be changed.

One of the things the task force is focusing on now is something that was not that useful for death benefits. It's the use of forward rates. For Guideline 34, you have an immediate drop and then a flat return every year. The task force is exploring something that approximates a certain percentile at every duration. Maybe the first-year drop isn't as severe, and the first-year recovery is very low, but gradually the returns will get more and more positive as time goes on. The task force is also in the process of expanding the historical database, to extend it from 1995 to the present.

The GMAB will be relatively straightforward for the Academy. The GMIB is going to be very complicated. You have to introduce a method for interest rates and

decide what to do with annuitization. It's an interesting situation where some actuaries talk about using a 100% annuitization at the first possible time, for reserving, since that's consistent with CARVM. But for risk-based capital (RBC), you don't necessarily do that. With RBC, you tend to use more realistic assumptions. This creates a situation with GMIB where the reserve calculation could create a larger number than the same calculation for RBC. That's something that still needs to be addressed.

Ratchets under this approach are likely to be onerous, and that's not a knock on this reserve approach. It is probably a knock on ratchets. When you have a product with a waiting period and you include ratchets, then you don't have a product with a waiting period. As a risk taker, if you want the waiting period to help with pricing, you'd better think twice before including a ratchet.

Financial reinsurance may still play a role in living benefits because of the 100% annuitization rule. It may create reserves that some people think are overly conservative because of the 100% factor, and people that structure financial reinsurance may find this interesting.

Let's wrap up with a little bit on the reinsurance market. On an expected basis, the savings for retaining this risk are absolutely huge. It's hard for those of you on the retail side, who know how hard it is to fight for an extra two or three basis points, to see that you are giving up 10–15 basis points on an expected level (Chart 1). But, even though it seems like reinsurance isn't much of a bargain on an expected basis, this is based on claims only. If you include potential reserve and surplus costs, reinsurance begins to make sense. The other thing to note is that once reinsurance is in place, it's done. Some catastrophic events will barely show up in an expected calculation, but if they happen, you'll be glad you reinsured.

Is reinsurance popular? Of the top 25 VA writers, which in today's environment happens to be companies writing \$1 billion a year, about 75% have used reinsurance at some time for death benefits. Of those that offer living benefits, more than 85% have used reinsurance at some time, and it's unlikely that the remaining VA writers would differ much.

How will reinsurance be structured in the future? I think there's going to be a range of approaches based on niche marketing. Risk sharing is going to be noticeable, but it doesn't have to occur at a point where it's realistic for an outcome to happen. And companies are going to move away from original term treaties. They can afford to discriminate, and I know that's not good news for those of you on the direct side, but that's the reality. I think, in the short run, there's likely to be new business limits, as for both time and the amount of business that you put on the books.

Mr. Jean-Francois Lemay: I am a pricing actuary at RGA Financial Products. I will start by talking about the size of the Canadian market and the segregated fund market in Canada. I'll touch a bit on the types of guarantees embedded in those segregated funds and on the reserves and capital requirements that we have in Canada for these types of guarantees. I will also very briefly go over the current reinsurance market in Canada for these types of guarantees and the issue of using reinsurance to manage the risk of these guarantees.

What is a segregated fund? That's the life insurance equivalent of a mutual fund. These products are very similar to the variable annuities with GMDB and GMAB guarantees that you have in the U.S. It's just a slightly different product design. But from a risk perspective and a reinsurance perspective, you're looking at basically the same type of risk as in the U.S.

These products have been around for quite some time in Canada, but only recently have you been seeing these new types of guarantees, and that has created quite an increase in the in-force amount. Currently you're looking at somewhere around \$60 billion Canadian of in force. It has been picking up recently and that, of course, has attracted some attention from the regulators as to how these things are treated in reserves and capital requirements.

It's quite similar for the type of guarantee. Perhaps the main difference is that the U.S. has maturity benefits. I'm talking about the typical product design. There are several types of products with all kinds of features, but I'll be talking more about the common type of product. You have a maturity benefit, which is typically 10 years from the date of issue or the date of deposit. After 10 years, you're guaranteed a certain amount of that deposit. Typically it's 100% or 75% of the initial deposit. You see more and more the 100% type of guarantee. If I put in \$1,000, at the end of 10 years, no matter how the segregated fund has performed, I get at least \$1,000 back. We also have death benefits that are similar to the GMDB. It could be a flat 100% guarantee or a 75% guarantee. And the guarantee is calculated on the portfolio. If I have several funds, the guarantee is calculated on the sum of these funds or on a fund-by-fund basis, but you see more of the portfolio-type guarantee.

One of the most peculiar features that causes some problems in, for example, modeling is the famous reset feature. I have this maturity benefit, which is 10 years from my deposit date, but at some point in time, I could decide to reset this guarantee and say, "My account value is not substantially higher than my guaranteed amount. I will now reset my guarantee." This means my maturity will be pushed back to 10 years from the date that I reset it. I lengthen the time of my guarantee, but at the new market level and the new account value. So I can lock in a gain on my guarantee by pushing it back to 10 years from the date of reset.

That introduced the element of policyholder behavior. If I want to reserve, price, or do anything with this, I have to make some assumptions about how people are going to use this reset. Are they going to be very rational about it or ignore the reset or just do it in a random fashion? That's quite an important issue. And, of course, we've seen other guarantees that have ratchets and rollups and basically the same types of features that you can see in the U.S. GMDB products.

I'd like to talk about reserve requirements. The current recommendation of the Canadian Institute of Actuaries (CIA) is that reserves are to be the greater of stochastic reserve or deterministic scenarios, and you need to take risk management strategy into account. You will have some deterministic scenarios that are prescribed, and you will also have to do your own stochastic calculation. And, to be conservative, you're going to be taking the greater of the two as a reserve. Stochastic scenarios would be the preferred method, but it's quite difficult to have a consistent treatment in accounting. The profession is not at the point where it could have a model that would be used across the board. That is one of the main issues. Right now there are no guidelines on this, but they may come in the future. All we're told is to do our best on your stochastic model, but have the deterministic as a minimum as a backup.

Deterministic scenarios are very similar to Guideline 34 where you have scenarios that would have a prescribed drop in the market, one for each type of fund, and then are followed by the recovery rate. Furthermore, because we have reset features in Canada, the scenarios also prescribe that 75% of the policyholders would reset if that would increase their guaranteed amount. That means that, as soon as their current account value is greater than that guaranteed amount, they would reset to the new product. That's not necessarily the most rational behavior because you always have to consider the trade-off in lengthening your guarantee. For example, if you're five years down after you've deposited, you now have a five-year guarantee. The trade-off is that you can reset for a greater amount but for a guarantee that is now 10 years away. What is rational would be deciding whether the five-year option that is currently a bit out of the money would be worth less than the new at-the-money option (that is, the new reset option, but now with a 10-year guarantee). Lapses also are prescribed at 5% per year. It's a very firm valuation, so at least it's consistent for everybody.

Table 1 lists the prescribed scenarios. If I compare them with Guideline 34, these are bigger drops. It may have a more conservative valuation basis than Guideline 34 has, but it's basically the same thing. The riskier the fund, the bigger the drop you have to assume and the higher the overall return that you have after recovery.

TABLE 1
DETERMINISTIC SCENARIOS

Fund Volatility Characteristics	Drop	Total Return
Money Market	2%	1.50%
Volatility between bond and money market	15	3.25
Bond	20	4.00
Volatility between bond and diversified equity	25	5.00
Diversified Can/US/Global equities (TSE/S&P)	30	5.75
Volatility higher than TSE	35	6.50
Riskier finds	40	7.00

Table 2 shows some reserve numbers. These are just examples to illustrate the problems that you have trying to pick a reserve number. The problems that you have when you try to reserve on a deterministic scenario is that in evaluating these options, the risk of the option, is very much a stochastic problem. If you look at the distribution of loss, the distribution has a very large tail. It's very much a catastrophic loss. It's a small probability but large losses kind of scenario, and it becomes very difficult to pick the right scenario that gives you an appropriate reserve. For example, on the first line, I have an example of a 10-year, 100% guarantee on an equity fund. I'm just using something very simple: a 10-year put option. There are no mortality figures, no resets, and so on. These numbers can be easily reproduced. I came up with a deterministic reserve of zero. If you follow the formula on the deterministic scenario, you have a drop prescribed and then a recovery rate, but this guarantee 10 years from issue is long enough so that the fund has fully recovered when the put matures. You have no reserve that would come out of this.

TABLE 2
COMPARING RESERVES FOR A PUT OPTION ON AN EQUITY FUND

Option	Deterministic Reserve	Stochastic, 95% Percentile	Hedging Cost
10-year, 100% guarantee	0	374	93
10-year, 75% guarantee	0	221	37
5-year, 100% guarantee	124	389	96
5-year, 75% guarantee	0	193	29
6 months, 100% guarantee	273	199	64
6 months, 75% guarantee	35	0	4

*All figures are in dollars, for a \$1,000 initial deposit

I'm using a 20% volatility. I'm using the Black-Scholes framework, and I'm running it to get a 95th percentile reserve, for example. You could reserve a different amount, but I'm just throwing out an illustration here. You would come up with 374, which is quite a difference. The deterministic reserve gives you zero because you're not holding very much of a reserve there. However, in holding a 95th percentile reserve, you would be holding something much more substantial. Now

compare this to the hedging cost, which could be seen as the value to reinsure or hedge this option. The stochastic 95th percentile reserve is almost the same for the 10-year and the five-year guarantees, but your deterministic reserve jumps from zero to 124.

For example, if you are reserved for the portion of people that are going to die next year (on average, they're going to die in the next six months), then for just that portion of the benefit, you have a 100% guarantee that basically is a six-month put option on the fund. The deterministic reserve is 273, and the stochastic one would be 199. Now your deterministic reserve has jumped above the stochastic one, and that compares to a hedging cost of 64.

There is a problem trying to pick a number because the distribution is very much like a cliff, so you have no losses for many of the scenarios but, for other scenarios, you have very large losses. Depending on which point you take, you're either on or over the cliff. You may have a very large reserve or no reserve at all.

As recommended, when taking hedging into account, any risk management strategy should be taken into account when calculating reserves. Obviously, if you're hedging, your hedged reserve would be much less volatile than your unhedged reserve. Your results would be much less volatile. Therefore, your reserve would be smaller, if you're picking a percentile. The expected value of hedging costs may be different from expected claim cost. I won't get too much into that, but when you're talking about hedging, you're doing something different from the traditional view of looking at your expected claim cost and putting a percentile into that expected claim cost. You really have to look at the expected hedging cost, which may have different value. And, it is difficult to take hedging into account under a deterministic scenario. Hedging assumes a certain volatility, especially if you're doing dynamic hedging; if you're buying put options or a static hedge, then it might be a lot easier. The cost of doing the dynamic hedging depends on how volatile the stock is and not so much on how it performs over time. These deterministic scenarios are lined up to try to give you one scenario. One scenario goes down and recovers on a very smooth line, but it hasn't been done with the volatility of that result in mind. It could give you some strange results if you were just blindly going to put your deterministic scenario into your dynamic hedging method.

Looking at Chart 2, you can see the payoff of your option unhedged. Under most of the scenarios, the losses are zero, and there are more scenarios in this case. The stock market ends up higher than the initial value, and you don't have to pay anything. That's all fine and dandy for most of the scenarios, but for the ones that don't end up higher, the claims can be quite dramatic. You have this very steep curve that illustrates the problem of reserving. If I reserve at the 50th percentile, I

get zero reserve. If I reserve at the 80th percentile, then I got the very large reserves. Depending on the product, this cliff can be much more to the right or much more to the left. It depends on which percentile you pick.

If you're hedging, it's a much flatter line, so your hedging results are much more stable over time. At the 50th percentile, you have about 100. At the 70th percentile, you have 110–120. So it's much more stable than the unhedged reserve, which, at the 50th percentile gives you zero, and at 70th percentile gives you 150. Many things can affect the volatility of your hedging cost: basis risk, how frequently you rebalance, liquidity risk in the market, and so on. I have some assumptions in there for all of these risks.

The point is to show you that you have a very different risk profile with each scenario. And let's not forget the unhedged line. That's quite difficult to obtain. You have to make an assumption on the expected growth rate of the fund in the future. That is quite a difficult task, and when you're hedging, you don't really care because what really drives the process is how volatile the fund is. Extracting the percentiles of these two charts shows that the unhedged reserved would be much greater, and it's a very steep curve if you're reserving at the 90th or the 99th percentile.

What are capital requirements in Canada? Well, so far, none. There are no standards. There's nothing on segregated funds, although the Office of the Superintendent of Financial Institutions (OSFI) has requested some sample numbers on these and tested some scenarios that have to be reported. OSFI will most likely be rendering a decision on the requirements for these over the year, probably by year-end. They will likely take the same form as the deterministic scenarios that the CIA has put forward, and that could potentially be quite large. As you can see, depending on what percentile they decide these requirements should be, this could be a very large amount, indeed.

The reinsurance market in Canada is almost nonexistent. You'd probably be lucky if you get a quote on this. At a certain point in time, some reinsurers were there, and then they pulled out. It's quite a difficult market in which to get reinsurance. Competition has not been there to drive down prices as much as we've seen in the U.S. In the U.S., competition for reinsurance on GMDB has been quite fierce, and the price has been driven down. But, in Canada, I don't think there has ever been a time when two reinsurers competed on the same quote. Also, if you're trying to reinsure this outside of Canada, you'll run into the usual problem of getting credit for ceded reserves, for example, for an unlicensed reinsurer in Canada.

There's also going to be a problem in getting credit for hedging. If the reinsurer is unhedged, he would have to reserve with that unhedged line, which has very steep curve, so it could potentially be very damaging. If the reinsurer is hedging, and you need to take that into account, it would reserve looking at the hedged line, which is a much lower reserve. If you're unlicensed, there will be issues. If the hedges are either not held in Canada or, for some other reason, don't appear anywhere, then you can't take credit for those hedges. You would have to reserve on the black line even though you are hedging. There are all kinds of issues that need to be addressed when you're trying to reinsure outside of Canada.

There are some advantages of reinsurance. You get rid of all your risk (if you're getting a full reinsurance) and get full reserve credit for this. That's the best way for the cedant to go. All the problems are all gone. Of course, you're still left with some counterparty risk.

Reinsurance can be difficult to unwind if you no longer want it. It could affect the viability of the product. Since the reinsurance market in Canada is so thin, a reinsurer might, at one point, accept any new business. And, if you're not ready or willing to take on the risk or hedge, then you may have to discontinue the product that you're selling. That's a bit of a risk. And it could be potentially expensive because of the low amount of competition.

The reserve numbers for deterministic and stochastic are not very stable but they work the same way when you're trying to cede (Table 3). For example, if I look at the middle line which is 50% coinsurance, this is an example of a five-year put option, 100% guarantee. If I cede 50% of it, then it costs me 50% of the cost, and I have 50% of the reserve credits; then everything works fine. But if, for example, I want to keep the first 10% of the loss and reinsure the rest (here I call it "90% cat cover") that would cost me 64. I would get a very large reduction in my stochastic reserve by putting that in, but actually a very low reduction in my deterministic reserve. If, on the reverse, I was going to reinsure the first 25% of my loss, but I'm willing to take on the very catastrophic risk, then my cost of reinsurance would be 67, which is basically the same. I would have a much smaller reduction in my stochastic reserve but almost a full deduction of my deterministic reserve.

TABLE 3
EFFECT OF REINSURANCE ON RESERVES*

Reinsurance	Cost of Reinsurance	Reduction in Stochastic Reserves	Reduction in Deterministic Reserves
90% Cat cover	64	310	46
75% Cat cover	29	193	0
50% Coinsurance	48	195	62
First 10% reinsured	32	79	79
First 25% reinsured	67	169	124

*5-year put option, 100% guarantee

So it's no longer obvious how it's going to affect your reserve once you use reinsurance, especially if it's not just a pure and simple coinsurance. These are things to think about when you want to use reinsurance to cede the risk. You're going to have some strange effect in your net results because your ceded reserve may not be exactly as you thought it would be.

Mr. Ruark: Jean-Francois is the expert on the reinsurance on the Canadian side, and Mike is our expert on the domestic U.S. side. Mike was formerly with Swiss Re, but is now with AXA.

Mr. Michael W. Pado: I'm going to cover five areas rather briefly, hoping to leave some time for questions at the end. In terms of the new benefit guarantees, the variable annuity market has been in existence for quite some time, but recently there seems to be a spirited evolution with respect to both death-benefit and living-benefit guarantees. I will talk about them from a slightly different perspective than our other two gentlemen by focusing on the risk amounts that are connected to those benefit guarantees, the drivers that give rise to those risk amounts, some risk management issues, and, lastly, managing the risk via reinsurance.

There are three risk management alternatives that may be used in different combinations. They are as follows: retain the risk, enter into a capital markets hedging program, or utilize reinsurance. These may be used in combination and need not be mutually exclusive.

In terms of the death benefits, in an effort to generate more sales, gain shelf space, and conserve business, companies have attempted to design a whole range of newly enhanced benefits. The first one that seems to have hit the product shelf was the guaranteed minimum death benefit with the return of premiums, rollups, resets, and ratchets. They're now fairly common with respect to most products, but we still see innovation relating to them. Not as much as the others perhaps, but companies are still trying to find little, innovative twists with respect to them. In terms of the guaranteed minimum income benefits, I believe Equitable came out with the first

GMIB back in 1996. Since then, there has been a huge amount of interest in trying to replicate its success, but not necessarily the product. There has been an attempt to generate as much sales success as the benefit apparently did. Even more recently, the guaranteed minimum account benefit was introduced. I thought that the Travelers had introduced it. With due reference to Mr. Carney, I think he said his company, IL Annuity, generated it first. It's an interesting concept, one that basically marries a maturity guarantee to a deferred variable annuity.

We've also seen a lot of interest in variable immediate payout annuities providers trying to establish a guaranteed benchmark payment out into the future to protect from the downside. Future innovation is likely to include rollups and ratchets. I won't talk very much about them today but no-lapse guarantees seem to be generating interest as well. And, lastly, the GMIB is a reference to all the newer product designs that are currently on the product architect's drawing table. I believe that these enhanced benefits are what separates deferred variable annuities, in large part, from mutual funds and has given rise to their popularity.

There are really four major classes of risk on all insurance products. First you have mortality risk. And I think we have to ask ourselves the question, does anybody really know what the mortality level is with respect to deferred variable annuities in the first instance? How about variable annuities with enhanced benefits? And what about Tim's question about antiselection? Do we know a lot more about mortality with optional enhanced benefits?

In terms of persistency risk, the same sorts of questions can be asked. You don't know how people who are paying for these optional enhanced benefits will behave or how the guarantees might affect their particular persistency on the product as a whole.

Third is election rate risk. That's the wild card in all of this, at least for the GMIB anyway. It makes a huge difference what level of election you assume. People who reinsure the benefit do not believe it's a static number. It's more like an election rate curve. The shape and size of it really affects the risk.

Finally, there is capital markets risk, perhaps the most important risk class of all, as it drives all of your enhanced benefits closer to being either in or out of the money. It's a lever on your entire portfolio. Let's see how these risks combine to affect resulting risk amounts.

I didn't think a presentation by an actuary would be complete without a formula, so I've thrown in some. It has been standard to define the death benefit as the greater of three elements: (1) the current account value, (2) the premiums accumulated with

interest, which could be 0, 5%, or even 10% because some companies are considering that, and (3) the death benefit at the N th year anniversary (which could be a reset or a ratchet design).

In terms of the risk amount, I like to think of it as two separate pieces. In general, I would define it as the death benefit less the cash surrender value. But you can break it up into two separate pieces, first the death benefit less the account value ($DB - AV$), which I refer to as the variable net amount at risk, plus another component I refer to as the account value less the cash value ($AV - CV$). Tim mentioned it earlier as a contingent deferred surrender charge (CDSC).

The thing to note about the first portion is that it's potentially quite volatile. People charge for volatility. The second piece, the CDSC, is quite stable by comparison. And if you combine the two, it has a positive effect on the overall cost per unit of risk, at least in my mind. The claim cost then is equal to the total risk amount times the mortality rate times the persistency rate. The key driver for the GMDB, of course, is the mortality rate that I referenced earlier.

The GMAB is the maximum of two elements: (1) the current account value or (2) some percent of initial deposit at some future time N . Currently, it could be simply a return of value—your initial value perhaps—but it doesn't need to be. It could be rolled up at a certain rate. I think the Travelers guaranteed 90% or 115% of the initial value at the end of the eighth year. The risk amount is equal to the difference between the guaranteed value and the account value at that future point, and, thus, the claim cost is zero until N . Then you have a cliff, so to speak, with respect to the risk amount, with the claim cost equaling the risk amount times the persistency rate. All you need to do to get it is simply not lapse or die. It's a much more expensive benefit as a result.

Let's look at a guaranteed minimum payment amount for an immediate variable annuity. It's the higher of the calculated payment using an assumed interest rate (AIR) calculation or the benchmark payment. The latter may be equal to $x\%$ of the initial payment. Again, that could be indexed or ratcheted. There are a number of designs currently being contemplated. The risk amount in the future then would be equal to the benchmark payment less the calculated payment, with the claim cost simply being the risk amount times the longevity rate. All you need to do is be present to receive a payment under that option.

Lastly, under the GMIB, you have an opportunity to choose the higher of one income stream (the current account value/current purchase rates) over another (the notional account value/guaranteed rates) after some waiting period, W . The risk amount is equal to the present value of the difference of those two income streams,

less the account value that's there to support it. The big ticket here, though, is that you need to factor in a liquidity give-up to get to that income. The claim cost, similar to the other GMAB benefit, is zero during the waiting period and then afterwards jumps up to equal the risk amount times the election rate times the persistency.

It may not be very clear what the claim cost curve looks like. You actually have to do a bit of modeling work to determine whether 100% election at the first possible time is the most costly event. Our analysis shows that it may not be. It's possible that if you defer pulling that election rate trigger and wait until the next period when the market performs much more poorly, you can get a much higher claim cost. It's a very difficult claim cost function to take a look at.

In summary, the risk amounts and claim costs associated with the guaranteed death benefit, account benefit, variable immediate payout annuity, and the guaranteed minimum income benefit vary substantially. It pays to look at them from the point of view of the following three items: the number of claims, the timing of the claim, and the amount of the claim. I won't go through all of them, but it's fair to say that, under the GMDB, you have just one claim. You don't know its timing, and you don't know its amount. Under the variable immediate payout floor, you have the opportunity to have multiple claims. You don't know when they'll be and you also don't know their amount. So these are slightly related, yet different, in terms of their claim cost profiles.

The GMAB, in part, can be looked at a little bit differently. For the GMDB obviously you need to persist and then die in the money as it were. For the GMAB you simply must persist until the end of that N -year period. For the income benefit, you can neither die nor surrender and then elect while you're in the money. There are all sorts of behavioral things going on in terms of the claim cost. And, of course, for the variable immediate payout annuity, all you need to do is survive. After you buy the contract, you'll either get a top-up payment or you won't.

Let's look at these risks from a slightly different perspective. I've broken them down into four general types of risk drivers: market-related risk, behavioral risk, distribution risk, and other risk. The first, and perhaps most important, are the capital markets risks. Here you're focusing on things like return and volatility. Tim gave some examples about the rollup rate versus the total return. It does need to cover the M&E fees, the administration fees, the contract charges, and even the cost of the guarantee that you're trying to add to the product. Anything that's dragging down the total return increases the strike rate in terms of the risk management.

In terms of volatility, it's quite important for any type of ratchet benefit. If you just start out and the market does nothing for one year, you're already down by the amount of all those charges taken out of the contract. It just drops. We also have some issues regarding the fund manager risk overlooking these types of deferred variable annuities. It seems to me that each contract has somewhere between 12 and 24, or maybe even 36 different funds. And what those fund managers do can affect your claim cost profile. If one of them makes a big bet and ends up coming up short, it can affect all of your contracts within your portfolio. That's something that is hard to diversify within your own companies.

In terms of behavioral risk, we talked about mortality and persistency already. But, in terms of transfer activity, many of today's variable annuities allow flexible, if not unlimited, transfer between the separate accounts as well as some flexibility between the separate accounts and the fixed accounts. If you do some analysis with respect to this type of behavior, it will show either an increase or a decrease in the net amount at risk and, hence, your claim cost going forward.

Another behavioral risk that is not talked about very much relates to the GMDB, namely claim submission. It turns out that these are options. You've heard people talk about the optionality of these benefits, and they certainly can be viewed as options. In terms of claim submission, the ultimate payout by you, the direct writer, will be affected by the time at which the beneficiary submits the contract for payment. The claim is not settled until proof of death is received. It could be that the market moved up or down after the date of death. Some companies have tried to constrain that additional optionality by putting in a 90-day limit, but you still have some risk within that period as the market moves up and down.

The next thing and final driver of behavioral risk relates to spousal continuance. Many companies allow a surviving spouse to pick up or assume the contract after the first spouse has died. That sounds great, but you have a situation where the contract was filed with a level M&E fee, and, at a minimum, what has happened is that the second spouse has increased in age. For a death benefit guarantee, a shift in the average age is quite important in terms of the ultimate cost. Not many people factor that in.

You also have distribution risk. This is trying to get your arms around all the contributors to the risk profile. The only two factors I'll focus on are contract size and time. In terms of contract size, a lot of the modeling takes into account that there's an average contract size. You'll go through and do all of your projections and come up with an average contract. Let's say it's \$50,000. Your average risk amount turns out to be a rather small number from a traditional reinsurance point of view, but if you actually were a recipient of these data, you'd know full well that

you'd have a bunch of contracts at the low end of the profile. Then you'd have a very long right-tail distribution in terms of the number of contracts that get larger and larger in size. You'd have a situation on death benefit, even though it may not seem that way at first, which does depend on who dies. If the person with the \$3 million contract dies versus the one with the \$30,000 contract, it affects your results quite a bit. So, you need to factor that into not only your analysis but also your risk management arrangements as well.

The last point relates to time. By time, I mean strike diversification in a sense. As you're doing your modeling there is the tendency to assume that all of these average-size cases come in uniformly on separate days, and you have a nice spread of risks, but that's not necessarily the way it ends up working. It's very possible, for one reason or another, maybe even just chance, to get a whole pot of money in on one day, and have less strike diversification over the course of the year. It's something that you probably can't control, but you have to at least think about.

In terms of some additional risks, after all this analysis is said and done, you always have the possibility of modeling error. You definitely need a good set of assumptions. They definitely should not be static in nature but more dynamic in the sense that your lapse rates and your mortality rates fluctuate appropriately. You need an adequate stochastic process. You need to make sure that you have sampling sufficiency. In our work, we attempt to make sure of sufficiency. Because all the benefits are a little different, we make sure that the present value of the claims converges before we conclude what the sufficient number of scenarios might be. In some contracts, it might be 1,000. In others, it could be several thousand. But you need to make sure that as you're looking at the right-tail claim distribution that it's relatively stable. That's what you're pricing for.

You could also have a situation where the tax law changes. It may impair the profitability of your contracts. As far as I know, since there's no well-founded statutory basis for guaranteed living benefits, it's hard to claim a tax deduction in advance for the reserves that support them. That's something else that should be factored into this analysis. You have yet another risk that. After all this hard work and effort new competing products could render yours somewhat obsolete. There's not much you can do about it except keep your ear to the ground.

And, lastly, the regulatory environment may become somewhat adverse to your situation. The reserve framework is still developing as well as the RBC framework. You might find that, after putting a ton of this business on your books, and maybe retaining it, that you need to do some fancy footwork to get what you need in order to make sure you have the appropriate levels of reserves and RBC.

What are your choices? You can change the risk. That is, you can change the product design to make it more risk management friendly. That's not very popular. You can choose to retain the risks and hope that the present value of charges embedded in your contract exceeds the present value of the benefits, and some companies do that. They tend to want to do that more so for the death benefits than for the living benefits, but only in a limited number of situations. You can also implement a capital markets hedging strategy. And you can enter into a very warm and fuzzy reinsurance agreement.

Let's think in terms of changing the product design to make it more risk management friendly. Again, I note that this is not very popular with our marketing folks. One thing would be to charge off the guaranteed base instead of the account value. That would help stabilize the revenue, and put some of the risk back to the contractholder. Another obvious thing is to limit the aggressiveness of the guarantees. In terms of rollup benefits, we do see folks that continually want to push beyond 6%, 7%, and 10%. It gets increasingly expensive as you move along that curve. I've also had folks call up and ask about things like daily ratchets. It just proves that all this additional optionality given to the contractholder gets exceedingly expensive. They did put in a caveat, however. What they really wanted was a daily ratchet, provided it cost less than 25 basis points.

Now I'm going to talk about limiting the investment choices. I don't mean actually not having funds available within your fund selection. One way of limiting the cost is to package the funds into different categories. This will help reduce the volatility that somebody is going to charge in terms of risk management. When you develop those baskets of funds, you might also think about implementing some sort of asset re-balancing strategy to help keep it (the risk profile) on track.

And, finally, you can reduce the optionality. I'm talking about things like limiting the ability to transfer assets between subaccounts under certain conditions and perhaps limiting the free partial withdrawals. I think Tim mentioned before about buying the options and not having in-force to pay for them. I think that free-outs hurt you in that regard.

Let's talk about entering into a capital markets hedging program. The direct writer, either on its own or through a consultant, needs to have the ability to pool these risks and establish a critical mass before the program could actually become what I call transactionally cost-effective. If you're a large writer, it may not be a problem. If you're a smaller writer however, it's obviously more problematic. If you're going to enter into it, you'll need to deploy sufficient resources in terms of human capital and IT resources to keep the program going. You'll need to make sure that you're able to calculate your exposure periodically and measure the effect of the assets

you've purchased against it. If you do use derivatives, you will have additional financial reporting and tax issues in the form of increased reporting requirements. And you need to find a way to charge for and finance the upfront option premiums. You have a situation where you're charging people annually over the course of time while having to pay for the derivatives all at once. That requires a persistency adjustment as people lapse out of the contract. The capital markets tend to charge you all at once for the coverage that you're purchasing. It's like a mismatching in some sense. I think Jean-Francois mentioned that you also need to withstand the residual basis risk and timing risk associated with such a program. Then, of course, you're still retaining all of the behavioral and other risks associated with the products. Basically you've gotten rid of most, if not all, of the capital market risk, but you've kept everything else, and you need to find a way to quantify what that additional risk still is.

You can utilize reinsurance. In this case, the direct writer would have the ability to cede out most of the total risk. I'll get to what I mean by *most* later on. If you're dealing with a qualified reinsurer, you should be able to gain product development advice as you go along, investigating risk/reward tradeoffs between different benefit designs. It allows you to focus on product and distribution versus risk management. If you're still convinced that reinsurance may not be the way to go, consider the following. For those of us who took the reinsurance exam, the Tiller book listed 10 reasons to reinsure. If you check this list, it may look familiar to you. Virtually all of the 10 reasons apply with respect to these types of guaranteed benefits. Reinsurance does transfer mortality, lapse, and investment risk. It also provides for underwriting assistance, but with a different slant on it. It is not necessarily medical underwriting assistance, but product underwriting assistance. It also helps limit the catastrophic risk and total claims.

Let's talk about managing risk with reinsurance and what to expect. From my view of the marketplace, most reinsurers are going to expect the following list of items in different combinations. Reinsurers will require some form of premium stabilizers in the sense that the reinsurer may charge using some function of account value and the guaranteed death benefit as a premium base. They may also want to stabilize the net amount at risk using the CDSC in the definition of risk amount. You'll find that you get improved unit cost if you also reinsure the surrender charge net amount at risk. In terms of size limits, I don't believe that you'll find any reinsurer willing to take unlimited positions. It often happens with writing deferred variable annuities that somebody has \$10 million, \$20 million, or \$80 million. Everybody wants to take the money in, but nobody wants the risk associated with the guaranteed death benefit. I don't think you'll find anybody willing to leave that limit aside.

In terms of claim limits, some are going to impose either an absolute claim limit or a relative claim limit in terms of the reinsurance liabilities. That may be a function of retention, which is next on the list. I guess it has been historical in nature, but most reinsurers are quite fond of the fact that the ceding company retains some piece of the risk. If you employ size limits, claims limits, and all that other sort of thing, the direct writer is, in fact, retaining but somewhat on the high end. It may be considered a contingent retention in the sense that they might not hit those limits. You run the risk all the way up to those points.

New business facilities may also be somewhat limited by both time and dollars, as Tim mentioned. The length of coverage may not be unlimited, and this may not be consistent with the liability that you established in your direct contract, which is generally unlimited. And I think Jean-Francois mentioned the concept of unwinding. I believe that reinsurance agreements that cover these risks would have special recapture provisions.

There are four simple steps to initiating a relationship. Contact your favorite reinsurer early in the product development process to see how it can help serve your needs and understand your problems. If you're working with brand new products or concepts, it's wise to enter into a nondisclosure agreement to ensure confidentiality. Next, establish a set of mutual expectations as to what can be covered and what can't. Some dialogue up front, even before you put out your request for proposal, would help establish whether a quote is possible or not. If you get beyond all that, I think agreeing to a critical path in a reasonable time frame would be in order.

In terms of maintaining the relationship, just negotiating the first part of the deal is not enough. You need to stay focused on getting the treaty executed. My observation from having worked on the life side for a number of years and now on this side is that the process associated with these agreements takes quite a bit longer than, say, a term quote. It wouldn't be unusual if it took two to four months to put a deal together and maybe another two getting everybody to finish reviewing the treaty. So the whole process is relatively long.

I would also suggest communicating all product changes in advance of your rolling them out as it may affect the risk profile. The reinsurer may feel that the changes actually help reduce the risk profile and will improve the terms. Of course, it can go the other way as well.

In terms of providing timely and accurate data, I think you will be sensing that most, if not all, reinsurers will be requiring electronic seriatim data to help them manage the risk. If you are a reinsurer, you will need to be able to look at your emerging

profile to see how closely it matches what your pricing basis was. You'll also need to establish your current exposures for reserving purposes. Furthermore, you'll just absolutely need it to do any sort of risk management analysis, as grouping doesn't work very well for these risks. We have found that companies have been relatively willing to provide timely and accurate seriatim data.

Finally, you must establish a set of reasonableness checks using aggregate data, because we have found that, over the course of time, as people have submitted data, things occasionally get a little out of whack. Reinsurance administration is the last thing that anyone ever wants to think about and nonsensical things come though every now and then. As I mentioned, special resources are needed for reinsurance. I think you, the direct writer, will need special resources for managing the retained business as well to increase the chance of a positive outcome. Finding ways to stabilize the volatility of the revenue risk will go a long way towards creating a process that allows for repricing—a process not for repricing in-force business necessarily, but for repricing for future new business. Even if the reinsurer is using capital markets instruments to hedge its risk, which it should, the cost of capital markets instruments have a way of changing momentarily, so you can't have one price forever.

If the reinsurer is willing to take a certain amount of exposure under certain conditions, it needs to be able to move forward and adapt to current market conditions as you go along. Stabilizing the volatility net amount at risk will also help. It works best with GMDB. And, lastly, sharing in some of the risks makes most reinsurance managements feel more comfortable. They're not that crazy about hearing that they have 100% of the risk. It's not a good thing to tell someone above you. I think those are the four elements that would increase the chance of a positive outcome. In conclusion, I would ask that you call early and call often.

CHART 1
USING REINSURANCE

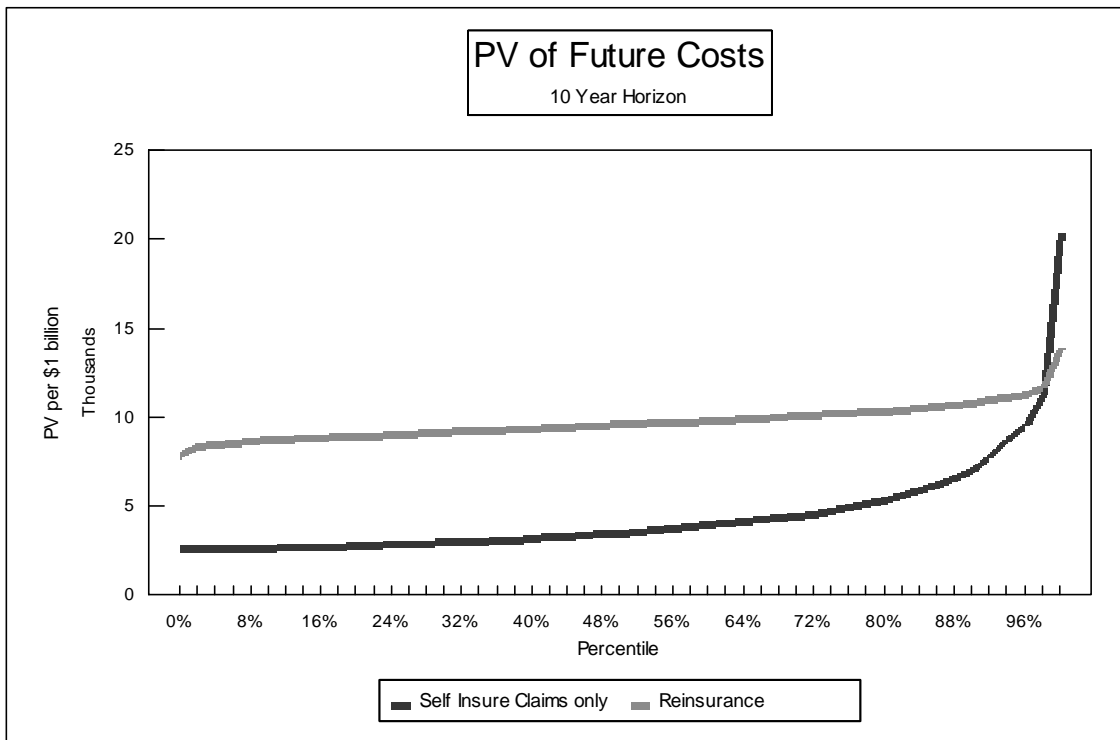


CHART 2
DISTRIBUTION OF COST
10-YEAR, 100% GUARANTEE

