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The Impact of Policyholder Behavior on Variable Annuities

Track: Investment/Product Development

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Summary: Variable annuities are often considered “riskless” because the policyholder bears the investment risk. However, policyholder actions can affect the profitability and risk profile of these products. This is particularly true where transfers between fixed funds and variable funds are available.

The panel discusses:

- *How fund transfers may affect expense recoveries through fee revenue*
- *How transfers between fixed and variable funds may impact required capital*
- *Product design features that affect the risk profile of the product*
- *Modeling considerations to quantify the policyholder behavior risk*

MR. KENNETH P. MUNGAN: I’m from Milliman USA, and I’m going to be the moderator. Before we get started, let me introduce the panel. Our first speaker is going to be Ulrich Stengele; he’s an asset/liability modeling ALM actuary from Nationwide, specializing in annuities. His talk is going to be a review of the modeling considerations for exchange behavior. After Ulrich, we have Marshall Greenbaum. Marshall is a senior vice-president for product development at Constellation Financial Management. Prior to joining Constellation, Marshall was a senior consultant and actuary at Ernst & Young. Marshall is going to talk about how Constellation Financial Management views policyholder behavior embedded within the financing that they do.

I’m head of the financial risk management practice in the Chicago office of Milliman USA. My talk is going to be a case study on the policyholder behavior modeling of guaranteed minimum death benefits in variable annuities.

MR. ULRICH STENGELE: My talk will focus on one aspect of policyholder behavior and that aspect is the option of policyholders to move money between different investment options—investment options in a separate account as well as in a

general account. I'm going to talk about four major points. First of all, general considerations: thinking about the effects that exchanges might have, what are all of the things that I need to be thinking about? Second, what do exchanges do to profitability? I'll be focusing on the statutory framework. Third, I have a mini-mini-case study for profitability. Finally, I have some anecdotal evidence. Let me start with general considerations.

Does the policyholder take on risk? I think we've all, in the last few years, gone to sessions where the question was asked whether variable annuities are a riskless business? I believe that even for an annuity with no guarantees, they're certainly not. If equity markets drop 20%, the cash flow income for the insurance company drops 20% as well. While GAAP might soften some of that blow, we have to deal with that in statutory accounting.

For the framework of the discussion, I need a stochastic model of the performance of my investment options—investment options both in a general account where I need interest rates, as well as in a separate account where I need equity, bond, and money market performance. A big question is, how many investment options should one model? Most annuities have dozens of investment options, and most of the time you can't even begin to try to model all these investment options explicitly. Therefore I need to aggregate investment options. How to do that probably depends on the application. For pricing, for example, it might be enough to say I have a general account option, and, five separate account options. The five separate account options basically reflect AG34 investment options, specifically an equity option, a money market option, a bond option, a balanced option, and a specialty option.

On the other hand, if I'm trying to actively hedge some kind of equity exposure such as asset fee income, I might have to model more investment options. A hedge depends on the correlation of my policyholder funds to whatever instrument I'm using to hedge that exposure. So it might be that just having equity in the bond and in the money market fund is not going to be sufficient.

Regarding the frequency of exchanges, one has to be really careful looking at history and translating these observations into modeling assumptions (or parameters). Real markets move every day and most models, at least the models that I've seen, are all either monthly, quarterly or annual. Therefore, in looking at actual exchange behavior I probably have to look at daily behavior. Finally, what should the functional form of the exchange function be? What should the parameters of that function be? First, what are exchanges a function of? Is it equity performance? Is it whether guarantees are in the money? There could be a lot of different aspects to that. Even if we know what the functional form should be, getting parameters for these functions certainly isn't a trivial exercise. And even if we're comfortable with the functional form and the parameters, we still need to be comfortable with what that function is doing with the parameters that we have. What is credible experience? Should we use the top-down approach? That is, should we look at our total block of variable annuities and essentially run a regression? Or, at the other extreme, use a bottom-up approach, where you basically look at each policy individually? Agent-based models have been discussed on this front.

Variable annuities are unique in the sense that they represent one of the few products where the insurance company, the policyholder, and whoever is in between have similar interests. They all want to maximize the account value. When we think about exchanges that's probably a helpful thing to keep in mind.

Policy features—I certainly have to look at these if I want to figure out how I'm going to model exchanges. Exchangeability rules, in the contracts that I've seen, can vary widely by policy form. Most have unlimited exchanges. Some have limits in certain directions. There could be limits on the number of exchanges. Often there are no restrictions for exchanges between separate account options. But sometimes there are restrictions when it comes to moving money from a separate account to guarantee general account options and the restrictions could be either way. If those restrictions don't exist in the policy as of certain dates, the insurance company will often actually reserve the rights to impose exchange restrictions. They might reserve their right. If the interest rates are suddenly 10% and the market drops, they might believe they have a good guarantee in the general account. I need to curtail flow into the general account, for example, but it might just be impractical to impose the restrictions.

The presence of guaranteed investment options is something that we need to look at in more detail. Although money market investment options are not guaranteed, I am including them here. Policyholders that move their money around a lot might park their money in a money market account if other separate account options don't do well. If interest rates go low in the money market account and we have a 3% floor in the general account, we might actually see a lot of money go into the general account. It might be that there are a lot of policyholders who have an "interest rate threshold." If the general account earns more than, say 10%, they don't care about potential returns on separate account performance but will move funds to the general account. They will take the 10% guarantee and move all their money to the general account. If the interest rates are modeled stochastically and interest guarantees are based on those rates, a 10% guarantee could happen.

The presence of riders is something that we need to scrutinize very closely. For example, if I have a minimum guaranteed death benefit that's in the money, with an account value of \$50,000 and a death benefit of \$100,000, what will a policyholder do? It could induce her to put all her money into the general account and keep cheap life insurance. Or she might invest that money in a risky way, in as much as the annuity will allow her to do.

Finally, asset fees and surrender charges—the asset fees not only determine how much the insurance company gets to keep, but the asset fee level also impacts the Commissioner's Annuity Reserve Valuation Method (CARVM) reserve level. Part of the reserve directly depends on the asset fees because we project separate account funds at the valuation rate less the asset fees. There is an interesting side note here. There seems to be a trend of replacing asset fees with what's called mutual fund house kickback. That also has an effect on the reserves that we should be considering.

The next question is, who generates the exchange activity to begin with? It's not

necessarily the policyholder that actually generates the exchange activity. Many policyholders give their brokers limited power of attorney that authorizes them to initiate exchanges. Since these brokers might get their information from the same source, there could be a large block of policies doing exactly that same thing. Therefore, one person deciding how to move money might actually impact thousands of policies. At least it is helpful to ask who generates most exchange activity. And as we'll see later in my anecdotal evidence section, it's usually the case that a very small percentage of policyholders generates the most activity.

All this points to the need of grouping policyholders into homogenous "exchange groups." For example, policyholders might just react to getting a quarterly statement. They'll do exchanges four times every year. Older age groups might take a more conservative stance. Market timers will act differently than buy-and-holders. Low account value policies are going to do something different from high account value policies. All this points to the need to group policyholders into different groups.

Another question that I think one should think about is, how are exchanges initiated? There are many options that a policyholder or broker can use to contact an insurance company. Usually there are voice response units. People can call customer service or initiate exchanges using the Internet. One question here is whether we see increases in exchange activity just because there are more options available to initiate any kind of transaction.

Market psychology is something else to look at. The psychology might currently be that markets will always bounce back. I'm not sure whether that's true any more. It seems unlikely that the NASDAQ will hit 5,000 any time soon. I would assume that exchange function parameters will change if market psychology changes. Therefore, the parameters themselves are dynamic.

The next question is, how do exchanges affect profitability? First is the CARVM effect. The CARVM excess is the account value minus the CARVM reserve; the allocation of funds between general and separate account matters for calculating reserves because projection rates are different. I have an example here. If I have a 4% valuation rate, a 2% floor in the general account, 150 basis point risk fee for the separate account, and a surrender charge schedule that starts at seven and grades to zero, then my fixed asset is half the size or less than half the size of my variable asset. That means if I have a billion dollars moving from the separate account to the fixed account then I'm going to generate a \$28 million reserve increase (assuming all else is equal) which goes straight to the bottom line. A billion dollars moving from the separate account to the general account sounds like a lot, but probably for most companies it isn't. Think about a set up where policyholders have 10% of their money in fixed and 90% in variable. If the variable allocation decreases from 90% to 80%, that doubles the general account. There are other issues with exchanges in or out of the general account. All of a sudden you have a billion dollars in the general account—what are you going to do? I mean, you can't invest that the next day. How and when are you investing those funds?

The next profitability aspect is risk-based capital (RBC). All numbers shown here are

pre-multiplier. The general account is a lot more RBC intense than the separate account. For example, a portfolio might have a C-1 factor of 30 bps and a C-3 factor between 100 and 200 bps depending on how surrenderable the funds are. The separate account has a 5 bp requirement. Given the asymmetry of RBC requirements, it matters where a dollar is invested. Is that dollar in the general account or in the separate account? General account margins are often wider than separate account margins. But dollars in the general account are much more capital intensive.

Let's discuss GAAP considerations. I would restrict myself to a statutory framework. If the general and the separate account have different levels of profitability, and money moves between those two options, then the shift in allocation can change my expected gross profits in the future. So I might end up with a change in deferred acquisition cost (DAC).

Hedge impact—hedging equity exposure (asset fees, guaranteed benefits): if I hedge using standard derivatives, the exact hedge position depends on the correlation of my policyholder funds with what the underlying of my derivative is. Because an exchange can change the correlation of the policyholder funds and hedge, rebalancing may be necessary.

I looked at a very simplified annuity to show the impact of exchanges. The single premium annuity has a fixed and one variable option. The credited rate is equal to the portfolio rate less a spread of 150 bps. The asset fee is 150 bps. There is a five-year reset minimum guaranteed death benefit. I'm looking at distributions of present values of distributable earnings. I'm sure you all know what distributable earnings are; they are after tax profits adjusted for target surplus. I have stochastic interest rates. On the separate account side, I have one variable option, that's the Standard & Poor's (S&P 500). I tested two exchange functions. The first one allows no exchanges. The second one is very simple—I calculate a rate going from fixed to variable and the rate going from variable to fixed. The exchange rate is simply the difference in return. For those of you that use PTS, that's one of the standard functions. I also look at different asset allocations, starting 10/90 fixed/variable, starting 10/90 and then finally starting 50/50.

I ran 50 scenarios, and for each of those scenarios, I calculated the present value of distributable earnings, sorted them and graphed them. If I start out with 10% of the money in fixed and 90% of the money in variable, and I turn on exchanges, then the results get a little worse. Why? Results get worse because if I turn on exchanges then, on average, I get a higher allocation in the fixed fund over time. In this example, a dollar in variable is a lot more profitable than a dollar in fixed. Then I started out with a 90/10 allocation. Now turning on exchanges makes results a whole lot better. On average, I'm going to have a lot more money in variable with exchanges than I did without exchanges. If I start out 50/50, exchanges makes things a little better. That's simply because, on average, equity returns are better than general account interest credited rates. On average, my allocation moves towards variable. A simplified example shows it is more profitable.

We finally have some anecdotal evidence. We looked at who generated exchange

activity. We took the sub-set of our variable annuity policies and looked at distribution channels, age, and account value (high and low). We looked at transactions in the first two months of this year, during which the stock market was pretty bumpy. Let's discuss the Standard and Poor's (S&P) total return from December 2000, January 2001 and February 2001. If I look at exchange behavior, looking at monthly data isn't a real good thing to do. The S&P starts out at about 1830 at the beginning of December, and it ends in December at about the same level. (If the level of the S&P doesn't make sense to you, that's Bloomberg's total return that includes dividends.) During the month, it goes up about 5% and it drops almost 10%. Just looking at the starting and ending points probably won't give us a good idea of what policyholders might have done. January is basically an up month, and February is basically a down month.

What did we see? Counting the number of transactions rather than looking at dollar values we found, for most cells, less than 10% of policyholders generated all exchange activity. We saw that higher account values are usually associated with more activity. We saw that the frequency of exchanges varies significantly with distribution channel; somebody that buys a policy from an agent is less likely to exchange money than somebody that bought their policy from a broker.

Incidentally, this might be a function of this what I mentioned earlier. If a lot of policyholders give brokers limited power of attorney, the policyholder might never know that he or she has actually done something. Surprisingly, the average number of exchanges per trading policyholder was relatively stable.

MR. MARSHALL C. GREENBAUM: I thought it might make sense just to give you a two-minute overview of what Constellation Financial Management does, which will give you a little bit of perspective on my thoughts. One of the reasons that you're probably not familiar with the firm is because it is not an insurer. It is not a re-insurer. It is not a hedge fund or an asset management company. So what is it? Constellation Financial Management is a company that's dedicated to the purchase of deferred cash flows for retirement savings products. The core retirement saving product that we have financed to date has been Class B shares of mutual funds. The Class B structure is the fund where an investor invests one dollar, and for every dollar that he invests, that initial dollar goes to work immediately for that individual. The distribution fees are taken out over time, typically over an eight-year period in the form of what's called a 12B1 fee. The 12B1 fee is named after the FCC rule. In addition to that fee, there's what we call a back-end loaded surrender charge. This is opposed to the Class A share of the mutual fund where the investor invests one dollar and four cents are taken out as an up-front sales charge. The remaining 96 cents goes to work for the investor with absolutely no contingent loads or sales charges taken out after that.

We're talking about policyholder behavior today and what it impacts. What you'll notice is a striking similarity between the risks embedded in that product or financing that I just described where we would finance distribution fee or that brokerage commission and get compensated via a 12B1 trail fee or distribution fee plus a back-end load. In the variable annuity, the insured is getting or collecting revenue in the form of a mortality and expense fee and any type of optional riders

where charges exist for guaranteed minimum death benefit (GMDB) and guaranteed minimum income fits, etc. Those are also charged as a basis point of account value. Those are what I refer to as asset-based charges. Then that back-end load, that contingent load that I talked about, a contingent deferred sales charge (CDSC) is very similar to the surrender charges embedded in insurance products. Then both typically grade over time. In the mutual fund world they typically grade over a six-year period, something like 5% graded down to 1%, and it's usually charged against the lower of cost or account value. I think that's similar in the insurance product. It is perhaps more common if there's just a charge against the account value.

Policyholder behavior has a pretty large impact on the guaranteed minimum benefits embedded in a variable annuity. That's something that Ken is going to talk about in detail.

We're talking about policyholder behavior today, and we're talking about it is because it presents some risk in the products if it's a variable annuity or cash financing for a Class B mutual fund. It is hard to talk about policyholder behavior risk without talking about market risk. Policyholder behavior can be driven by what's happening in the market, which is driving the underlying sub-accounts embedded in the variable annuity. Without a doubt, the primary risk is market risk. When the market declines, not only do our revenues decrease, but we also have an increase in our guaranteed benefit claim. So we get a double whammy there.

So how can the policyholder react? What options does the policyholder have to react to market events, industry events or perhaps the introduction of a new product such as bonus annuities? It turns out that the policyholder has the right to lapse the contract. Whether it's a full or partial surrender, he has the right to put the contract back to the insurer. This is referred to as a put option. The other option that the policyholder has is the right to select his or her asset allocation among the different sub-accounts or the different mutual funds embedded in a mutual fund family. Those are the ones that I'm going to focus in on. There are other ones that have particular relevance for our guaranteed benefit claims. That is the ability to annuitize your account value, which has extraordinary impact on the guaranteed income benefit. Here in Canada, with the Canadian seg funds and the guaranteed maturity benefit associated with them, the policyholder has a very valuable reset option, which is common in a number of the seg funds out there.

When I talk about policyholder behavior risk, I'm talking about it in this context. It's a very key point. The risk is that actual behavior that will play out over time is going to be different from what we've assumed in pricing and/or what we've assumed for hedging purposes. If we perfectly predicted policyholder behavior, then this really wouldn't be an issue. It's not just variability of what policyholder behavior is. It's how much of it we've built into the pricing and how much variability around that expectation that we need to earn some sort of risk premium for. We'll talk about it a little bit later. It's very difficult to hedge policyholder behavior with the capital markets.

I'll just read an example quickly. If we assume that pricing assumes a 5% lapse as

the market declines, and we actually get 2% lapses, we're going to take a loss. We're going to have higher GMDB claims than we expected in that scenario. If we hedged for 5%, we're also going to get a loss there because we haven't hedged the additional 3%.

Some additional comments about policyholder behavior are very important to keep in mind. The first one is that policyholder behavior is what I call sub-optimal. Referring to it as being sub-optimal from the policyholder standpoint means they don't always act in what is a rational and efficient way. That's actually a good thing. If we had to assume that they acted rationally and that they always optimized their benefits embedded in the contract, this would substantially increase pricing. They would probably price many insurers out of the product. We need to price for what we think is the expected behavior going forward, exactly like it's done in the mortgage-backed security marketplace, where mortgage-backed pre-payments are predicted on an expected basis. We model how we think behavior is going to happen instead of predicting on those scenarios where it's optimal for everybody to refinance and everybody does refinance. We know that's not a case.

The other thing that we need to keep in mind as we do pricing, is that it's very important. Policyholders that underlay these products are not a homogenous or heterogeneous population. We're going to need to keep that in mind as we model it and as we group that. We have different things to worry about now when we talk about assessing policyholder behavior risk. Not only do we need to break down our population via the typical demographic assumptions that we do. It's also important to break it down by the asset allocation that the policyholders have, which Ken is going to address. We also need to think about it in another dimension, which is how they're going to behave.

Another item to keep in mind in pricing is that if we think that behavior is going to be different, depending on what economic scenario we're experiencing at the time, I think it's important to model it that way. We should not have the same expectation of behavior for every single scenario, unless we really feel that should be the case. Even though we have some historical behavior to analyze, we need to keep in mind that there's no guarantee that policyholders are going to behave the way they have in the past, particularly if they see a scenario that they have seen before. I'm going to tell you about some observations on policyholders, and how they behave in the mutual fund. I'd like to think that if we get into an interest rate environment, like the 10% and 12% interest rates that we saw in the early '80s, maybe some people will invest longer than bank accounts or short-term securities.

Here are some observations that we've seen at Constellation as we've analyzed policyholder behavior. These comments are with respect to lapsing or redeeming their mutual fund. First is that industry average for equity fund redemptions is less than 1.5% per month, or 18% per year. You must keep in mind that is for all class shares and that includes the Class A share where there's no back-end load. You'd expect higher redemptions for that particular share. Then for equity fund exchanges, which are exchanges within the mutual fund family, the industry has seen an average of approximately 1% per month or 12% per year. Again, this is for all class shares of the mutual funds for a total of 30% activity within the equity

fund sector of mutual funds.

The third point is that when we do financing for Class B shares, that's the particular share structure that we're interested in analyzing the behavior of. Obviously, we see average redemptions much lower than the 1.5%. They come in at something like 0.75% on average or 9% per year, because of the presence of the back-end load. Lastly, we don't keep track of this on our database. Studies have shown that a higher percentage of redeemers are new investors. Roughly half of those that actually redeem have owned their funds for two years or less. That's perhaps important when you're modeling cohorts of like behavior. You might want to distinguish between who has been investing for a period of time and who has not, so you can predict all lapsation and segregate the population accordingly. Here are some observations that we've seen with respect to asset allocation and investing behavior. The first item was quite surprising to me. When I took a look at the database and I tortured the data and looked at it every which way, I was actually looking for some sort of correlation. I couldn't come up with any correlation between rebalancing activity and redemption activity, with respect to market movements. I had a pre-conception on that assumption and for many years thought that we would see higher redemptions when the market was moving down, and lower redemptions when the market was moving up. But I just didn't see it, and as much as I tortured the data to make it confess, which is something you're not supposed to do, I just couldn't get there. What we have seen is a very high correlation between market movements and new sales, which is probably something that seemed intuitively obvious. When the market is down, people get a little hesitant about putting new funds in there. But when the market is doing well, they seem to ride the wave, investing more heavily in equity funds. Not only does the volume of sales change, but also the allocation between the funds changes.

Very recently we've seen mutual funds families that had an 80%, 20% split between equity versus fixed income funds actually reverse, so we are seeing more like 80% fixed income, 20% equity. Some observations were made by the mutual fund industry, information that we don't maintain in our database, and this is consistent with something that Ulrich pointed out. There tends to be a small percentage of investors that move their assets often, but the overwhelming majority of them do nothing and they simply stay put and follow a buy and hold strategy. So getting back to modeling the cohorts of life behavior, it's important that you segregate those two out, if that's an important consideration in modeling and figuring out the pricing and risk management issues. It's particularly relevant for that guaranteed maturity benefit with the reset feature embedded in seg funds, because you're going to have individuals that are going to reset that policy very often and you're perhaps going to have some other individuals that just forget it's even there.

It has also been observed that investors' buying patterns tend to be consistent over time. People that tend to consecutively buy on declines keep buying on declines. People that tend to buy on the rise when the market is doing well keep following that consistent behavior. You don't see people switching over. They seem to get a philosophy stuck in their head and stick with it. The last point of observation is that the number of transactions seems to be insignificantly different

between taxable and non-taxable accounts. This is surprising because you'd think there would be more activity in non-taxable accounts where you could take advantage of deferring your capital gains.

There are some recent notable events to look at over the last couple of years to see how policyholders have reacted. In August 1998, there was a little market wrinkle, which I'll say was due to the blow up of Long Term Capital Management and some things that were happening in Russia. These events seem to support the observations that I've made. What I just mentioned is that sales drop from the previous month. They dropped roughly 25% from the prior month. That redemption exchange activity rose—it did rise, but I would call the rise insignificant. It rose roughly 0.5%, meaning that only one dollar in two hundred was really moved as a defensive reallocation. I mentioned that they changed their mix of funds with new sales. There was some evidence of increased cash allocations during that month. Only a small portion was the result of switching behavior.

Let's get back to torturing the data to make it confess. I was plotting charts and looking at a number of things. One of the things I was looking at was redemptions over a calendar month, and looking for patterns, trying to match it up with the S&P. I didn't really come up with anything. However, there was one outlier in April 2000 that stuck out at me. There was a 2% increase in redemptions at that time when it historically averages something in the neighborhood of 1%. It was pretty significant. I was trying to figure out what happened in April 2000. What caused this? For a while there I was stumped. I looked at what the market was doing, and I noticed that in April 2000, the market peaked. That was about when NASDAQ had hit its all-time high. For a couple of days or so I was running around the office saying, "What a great indicator I have here." When redemptions are up, or we see a little outlier, we have indications for a market decline. Actually, upon further investigation it turned out that this was really good market timing on behalf of the investors. What we saw was that they were just reallocating their funds. There was a large switch from value funds to growth funds. So they were actually new sales loads in tandem to completely offset what we saw in money going out from particular equity funds and mutual fund families.

Then in March 2000, we saw some collapsing market prices. For the first time, there was half of a percentage of equity assets, net redeemed from mutual funds. This wasn't really due to a large move in sales or redemptions. Redemptions went down and then sales went down enough to cause negative outflows. However, during that time we did see that value funds seem to capture positive inflows, so it's back to the poor market timing of individuals as they're now moving from growth to value funds as the growth sector is out of favor.

I did a graph and the X-axis goes from year one to year nine, and the Y-axis is redemption rate as a percentage of net asset value. I found a couple of interesting things shown by the curve in this chart. First, it appears that investors definitely tend to look at that surrender charge when deciding to redeem a Class B share, and a typical structure as I mentioned before is something like five, four, three, three, two, one. So as the back-end charge gets reduced, you tend to see an increase in redemptions, which is very similar to what we see in insurance products. As the

surrender charge declines there's a slight increase in lapsation. Not only is time having an impact; it actually looks like there's a leveling rate here, and that's that five, four. It stays at 3% a typical CDSC charge, which stays at 3% for two years in a row, which is the most common structure. So you see it leveling off. It appears that they actually are cognizant of that particular level of where the back-end load charge is. Then the other interesting thing to point out is at six years. This is where typically the CDSC, or the back-end load wears out. You would expect to see what we see in an insurance product, perhaps a spike lapse in this period. But from the evidence that we've seen from the data that we have, and granted we're kind of building up those years right at this point as we started doing these financing and keeping track of the data back in 1995, we're just trying to build up some good experience. But we don't seem to have any evidence of that spiked lapse, at least when we look at the entire database that we currently have.

The only rationale I can think of, is that perhaps investors are realizing that, after two years, their 12B1 fee is going to go away and their Class B share is going to convert to a Class A share. Effectively, they're going to have a reduced management fee going forward.

I also want to talk a little bit about risk management and risk transfer, because I've been so entrenched in it over the last three years or so. I want to start off with a quote from David Kaminski, the CEO of Merrill Lynch, who was quoted back in September of 1998 in the *Wall Street Journal*. He was responding to some fixed-income losses that they experienced at the time when there was a little bit of turmoil in the bond markets after the Long Term Capital Management situation in the summer of 1998. He went out to explain the losses why they obviously weren't hedging with a very good hedge. He said that the only perfect hedge is when somebody else owns it. In this case, they were trying to hedge an asset, but for insurers, it could be a liability. I also wanted to add that this is particularly relevant, because if you're looking to hedge your exposures and your market risk it's very difficult to hedge the policyholder behavior as I mentioned earlier. There's always going to be a bit of residual hedging risk that's due to policyholder behavior. There's also going to be a very large degree of residual risk.

There was another session on risk management tools. There was a little bit of discussion about residual and basis risk that's left over after hedging because you need to hedge your portfolio with a bunch of liquidly traded indices that don't necessarily match up to the underlying portfolio embedded in the sub-accounts. That residual risk is quite extensive. At Constellation Financial Management, that's something we look at and monitor every day. Keep in mind that we try to completely hedge our book out. We currently finance for over 30 mutual fund families comprising over 700 mutual funds, which consists of something roughly in the neighborhood of 50,000 security positions. At the end of the day, we have something that looks very much like index funds. The key point is that it looks like index funds. They are not index funds. Even with that tremendously large book, we are left with a residual volatility that is based as a percentage of the mark-to-market of our assets, something in the neighborhood of 2%. That means that if we're hedging \$100 million dollars worth of deferred cash flows, we have a plus or minus two standard deviations of \$4 million dollars. So if you translate that into

insurers trying to hedge their book with perhaps one mutual fund family with something like 20 to 30 funds, the residual basis risk is going to be a very large multiple of what we see.

There is something you can do if you don't like the policyholder behavior risk embedded in your products, especially if they look very risky even after analyzing them. I met an individual at the reception on Wednesday night, who said that his company doesn't write variable annuities, because it's just too risky. There's actually a lot of ways to make a variable annuity product not risky. This is one of them. I'm going to talk very briefly about what's referred to as risk transfer securitization where you just simply transfer all the capital mark and the behavior risk embedded in your products to the capital markets by issuing asset-backed securities. The way it works is an insurer would receive X dollars, and would give up the rates received for those X dollars. The mortality and expense fee doesn't have to be a variable annuity; it could be a SEG fund in which they're giving up distribution fees or something else. There is a CDSC or surrender charge fee for a specified period of time until the bondholders get paid back all their interest and principal. The way the asset-backed security note works is when cash flow start to come in, they start to pay down interest. If there's any cash left over, it starts to pay down principal on a pro-rata basis. Once the principal balance is zero, the structure is done. At that time, if it ends before the specified period of time, the fees revert back to the insurer. From the insurers standpoint, I view the retention of those back-end fees if things work out well, is that essentially the insurer is retaining a residual equity interest or a co-option if the bond holders get paid back early. That would happen if the market does really well. The fees that you're going to get from your mortality expense ratio are going to be high because they're based on the level of the account value. The important thing to keep in mind is that when you do this type of securitization, the fair market value of the fees that you give up are obviously worth more than X, they're worth X plus this call option.

I also wanted to add that the deal to date hasn't been done; there have been very few of them, but they've been done for cash financing purposes, not risk transfer. They've all been on balance sheet.

That's very quickly the flow of funds for this particular structure. Investors are on the rate giving up cash for the purchase of collateralized notes. There's always some sort of intermediary with a special purpose vehicle in the middle. It could be simply a funding trust that collects mortality and expense fees. The CDSC from the insurer gives the insurer the up-front cash from the note issuance. You don't know whether you are going to have the residual equity.

And last, I just wanted to conclude with a contrast of this to a purchase and sale agreement. There's another option to get around. It is avoiding that equity call option, which is to simply sell your management fee with a third party. It could be a combination of management fees and the surrender charge. In this structure, you would basically just receive one lump sum. Keep in mind the lump sum is going to be greater than X because you're essentially getting paid the fair market value for that call option being Y. In this particular structure, there's more risk transfer because you're guaranteed to get X plus Y in this case. If you're doing it for a

financing purpose, you get provided more cash than you would under that single issue or securitization.

MR. MUNGAN: I'm in charge of the financial risk management practice in the Chicago office of Milliman. In the work that I do, I come across three basic risks that insurance companies are interested in managing. That would be the risk associated with a fee stream. We're talking about the risk of managing a spread, such as on single premium deferred annuities (SPDAs) or the traditional kinds of risks life insurance, mortality, morbidity, and longevity risk. It really seems to be that this risk, the risk of a potentially volatile fee stream associated with variable products, is the hot topic. So I'm very excited to talk about this. I think the three talks fit together very nicely, and at this point we'll go into dealing with the guarantees the companies have made.

First, I'll just give a brief overview about guaranteed minimum death benefits. I won't spend too much time on that, as I think people probably understand it pretty well. I'll talk about the four important behaviors that we see from the policyholders on guaranteed minimum death benefits. First is volatility, and that goes to the selection of the portfolio. Policyholders are trying to select a portfolio to meet their needs. That could range from doing something sophisticated like running linear programs, to selecting the optimal portfolio, to doing something simple. For example, just looking at the front page of *USA Today*. Next would be fund transfers. How do they respond to market events? How does their behavior change over time? Finally, for the two factors that make up the main risk of GMDBs, what is the mortality rate and what are the lapse rates?

Let's first discuss guaranteed minimum death benefits. Are they just a minor add-on, or are they a serious risk management issue? I think if we had this meeting five or more years ago, people would have said, "They're just a minor add-on." Now, over time, as changes in the death benefits have been driven by the marketing side of organizations, it has become a serious issue that companies should address. There are different types of death benefits. They are returns of premium, ratchet, roll-up and max (ratchet, roll-up.) The first products were very simple. There is just a return of premium, so if the policyholder died in the down market, his or her beneficiaries were guaranteed to at least get their premium back. That was less of a risk management issue. New products emerged. One is a ratchet, also called a maximum anniversary value. It's an annual ratchet. You pick up death benefit ratchets up every time the policyholder passes through an anniversary in an up market.

Next is a roll-up. That's a benefit that's not path dependent like the ratchet is. The death benefit simply accumulates with a fixed rate of interest. Finally, there's the idea to give the policyholder the best of both worlds. Let's give him or her the maximum of the ratchet or the roll-up. We can think of product design as a competitive process where one company introduces a benefit, and another company sees a marketing benefit to topping them. Another one comes out with an even better benefit, and so on. So if this process continued unchecked next year we might be meeting to talk about the 15% roll-ups and the double maximum anniversary value benefits that are out there. At some point it has to stop. I think

that's where all of us come in. The companies need a risk management process in place. They need a process that's clearly defined that will explain what benefits the companies can offer. How much risk the companies can accept? Then identify very specific ways as to how the companies can manage that risk, either through reinsurance or capital markets hedging or calling Marshall.

So let's go through some of these risks. The first is volatility. As I said, policyholders are choosing between multiple funds to meet their needs. Companies might have 10-20 funds, or even more. Now for each of the funds within the family, an actuary can do an analysis on fund performance and develop some expectations in terms of returns, fund volatility, and fund correlations. Then you can view each policyholder as choosing a portfolio. That portfolio has volatility. Now the formula down at the bottom just comes from value at risk. You can view a diversified portfolio as having a single volatility that comes from the allocation among the different funds.

One thing that companies are seeing is that that portfolio volatility can vary substantially by policyholder. There are policyholders that are very risk averse, who are putting a lot of money into money market funds, and policyholders who are very risk seeking—allocating their money to high-tech funds, global equity funds, or other funds of that nature. What we can do to analyze this portfolio?

Equation 1

$$s = \sqrt{W^t \bullet COVAR \bullet W}$$

FROM THE FLOOR: Please explain the meaning of the variables in the formula for portfolio volatility (Equation 1).

MR. MUNGAN: W is the vector of weights. So if you had ten different funds you'd have a vector with ten entries that sum up to 100%. The matrix, COVAR, is just the covariance matrix between the different funds.

Now one other thing to note in this equation is the covariance matrix. You could decompose that into the matrix of correlations and then a vector of fund volatility. If you're making some subjective estimates, you could make some estimates for each one independently. Since we are talking about subjective estimates, I often find it is less useful to merely view this as an exercise in doing a historical analysis of fund returns. Don't be afraid to put your own professional judgement into the process. In work that I've done talking with Wall Street firms, I hear the same opinions over and over again. I hear that volatility in the market has increased and people don't see much of a reason why it would decrease. So if you look at a long-term historic estimate of volatility that goes back many, many years, you might be underestimating where lots of people think volatility truly is today.

Now lets do a simple example. Look at three basic funds. S&P 500, NASDAQ and Treasury bills. Just so that we have a starting point, I look at historical data over a ten year period. We have volatility and then the correlations of the three funds. Let's

see how we could use that in developing portfolio volatilities for some sample policyholders.

We've got three different policies: A, B, and C. There are also three different funds. That's a very simplified example—companies might want to look at five, six, seven, or eight funds and that represents the actual funds that they're offering. Of course, you have many, many policyholders. You can see I've developed portfolio volatilities for these three policies and they range from 8% for this fairly risk averse fund that has 60% allocation to S&P 500, 40% to Treasury bills, and 18.5 % for someone who's investing a lot of money in the NASDAQ.

Now the problem that insurance companies need to deal with is that the charges for guaranteed minimum death benefits typically don't vary by portfolio volatility. So that opens the companies to anti-selection, and you need to understand whether that's a serious or an inconsequential issue. The benefit of doing this exercise is that actuaries often throw up their hands when you see the huge number of funds that the company may offer. By taking this simplified approach, you're reducing the complexity of a multi-fund portfolio down to a single value. That's portfolio volatility.

Lets see what we could do with that. I'm going to present a very highly simplified stochastic model. We have a policyholder who's 65 years old and who has an annual ratchet for his or her benefit. The benefit continues to ratchet until age 80, at which time it freezes. It doesn't go away. The benefit just doesn't increase anymore. Lets assume that this was an add-on rider that the policyholder chose, for which he or she paid an extra ten basis points. We're going to look at results—present value at a 10% rate. Now I've made some assumptions as to lapse rates. We're going to look at results for these three different policies: A, B, and C. In addition to the volatility, which goes up for three policies, it also has some different expected growth rates. Here we see the long-term expected return that the policyholder expects from that kind of asset allocation.

Table 1

Stochastic Model Summary

Product Summary	
Benefit	Annual Ratchet
Issue Age	65
Benefit Lock Age	80
GMDB Premium	0.10%
PV Rate	10%

Here are some results from a model. This model, as I said, is very highly simplified. We're just looking at net cash flows. We look at premiums and claims, and then calculate net cash flows, premium minus claims over a thousand scenarios for the three different policies. You can see that results vary quite a bit. Just look at the average present value of net cash flows. The low volatility policy, on average, is

positive and high volatility policy is negative. Aside from the differences in the average, you have a very substantial difference in the risk of these three policies. Look at the spread between the first percentile and the 99th percentile of the present value of net cash flows. A company might want to define its risk tolerance in terms of this framework. For example, you could have a company that says, "Well, at the 5th percentile level, we want no more than X percent for this net cash flow value." You can pick a specified percentile value that you're willing to accept as a test. If you fail the test, you need to engage some sort of active risk management policy. Let's assume that the high volatility policy does fall within that range and that would trigger an alarm at the company that you really need to do something. You could look at reinsurance; you could look at hedging within the capital markets and try to find some ways to bring this risk down. You could also look at redesigning policies to these kinds of high volatility policies with rich death benefits that are more difficult to get. That's volatility. Let's go on to fund transfers.

Table 2

Stochastic Model Results

GMDB Stochastic Projection				
PV of Net Cash Flow, Percentage of Initial Premium				
Volatility		8.00%	11.70%	18.50%
Average PV of Net CF		0.55%	0.21%	-0.78%
Percentiles				
	1	-0.44%	-2.11%	-5.09%
	5	0.03%	-0.88%	-3.37%
	10	0.17%	-0.52%	-2.42%
	25	0.41%	-0.03%	-1.33%
	50	0.59%	0.03%	-0.53%
	75	0.73%	0.61%	0.06%
	90	0.87%	0.82%	0.48%
	95	0.96%	0.92%	0.80%
	99	1.12%	1.18%	1.52%

This is the option to switch between different funds, and that's going to affect the value of guarantees as well. That's something that Ulrich addressed quite well. We could think of a pessimistic scenario for the annual ratchet. It might look something like this. The policyholder selects a very high volatility portfolio, and then that portfolio experiences a sharp market increase. As that market is increasing, their benefit is ratcheting up. At a high point in the market, after the death benefit has risen to a high level, you have a steep market crash followed by the policyholder switching. Policyholders experience some anguish and sleepless nights over what's happened to them. They decide to move all their money into the money market fund. Unfortunately, I think that may have happened for a number of companies, so it's something that you want to look at. What you could do is look at a reasonable range of fund transfer rules, such as moving to low volatility after a market crash, and maintaining constant portfolio allocation. You could come up

with any number of rules, but use your own judgment as to what you think is reasonable. Then identify problem scenarios for the fund transfer rules that you think your policyholders are following. Of course, review the fund transfer data. I think companies with the administration systems that are in place have a wealth of data on fund transfers. It's just the question of digging into that database and trying to make some sense out of it.

Also recognize that some fund transfers are not market related. There has definitely been some evidence that policyholders reallocate over time. So you might see older policyholders that have a potentially lower risk tolerance, risk tolerance varying by a male and female in distribution channel. So taking all that into account, you can have a robust model that looks at portfolio volatility today and then potential changes in volatility through the fund transfer option.

Next is mortality rates. That's where the rubber meets the road for guaranteed minimum death benefits. Here we run into a cultural issue on pricing and managing variable annuities. Historically, mortality rates were not viewed as the key driver of variable annuity (VA) profitability. It wasn't something the company spent a lot of time on. It hasn't collected a lot of data and performed a lot of detailed mortality studies. Mortality on variable annuities is an important topic. Also, there are some features that often get buried in the products that need to be examined very closely. Guaranteed minimum death benefits at some companies could be viewed as a first-to-die policy on up to three lives. It could have a joint owner and annuitant, any of whose death could trigger a death benefit claim. Recent products are limiting this exposure, but now that GMDBs are significant companies, we really need to spend some effort on developing some view as to mortality and making sure that they understand what their real mortality exposure is.

Lapse rates have a big impact on the cost of guarantees. Obviously higher lapse rates are going to lower the cost of guarantees. The rider itself, the guaranteed minimum death benefit, has no cash value. Ideally, people would pay and select this benefit. They would pay premiums and then lapse their policy before a death claim is ever filed. There are many drivers of lapse rates as seen from Marshall's chart. The surrender charge run-off is one main driver, as is the change in the market itself as VA products have changed and companies have introduced bonus products and earnings enhancement benefits to pay taxes. The increase of new products has motivated a lot of surrenders and transfers into new products. That has an impact on the GMDBs on the old products.

Also, market underperformance may be important. If you believe that people lapse more in a down market, then that's going to impact GMDBs. If we got into a severely depressed market, then you might see persistency improvements on older blocks when they realize that they have a very valuable option that's deep in the money. To try and quantify what impact changing lapse rates can have, let's expand the testing that I've already shown. We'll take the medium volatility policyholder and then do two tests. One with the lapse rates that I've already shown, (Table 3) which I labeled as baseline. We'll just multiply those by two and see how much of an affect that has on the cost of the GMDB. You can see that the average is basically unchanged (Table 4) because we're looking at net cash flows

and both premiums and claims have been affected. But the evaluation of risk has changed dramatically. If you look at the risk for the higher lapse rates, you'll see that it has gone down quite a bit. It's very important to spend some time in your company's think tank and put as much effort and deep thought as you can into developing what you think are good lapse rates. It will have a big impact on your assessment of the risk.

Table 3

Lapse Rates Sensitivity Test

Product Summary		
Benefit	Annual Ratchet	
Issue Age	65	
Benefit Lock Age	80	
GMDB Premium	0.10%	
PV Rate	10%	
Expected CAGR	8%	
Volatility	11.70%	

Lapse rate Sensitivity Test		
Contract Year	Baseline	200% of Baseline
1	3%	6%
2	3%	6%
3	3%	6%
4	3%	6%
5	3%	6%
6	3%	6%
7	3%	6%
8	15%	30%
9+	10%	20%

Table 4

Lapse Rates Test Results

GMDB Stochastic Projection PV of Net Cash Flow, Percentage of Initial Premium Lapse Rate Sensitivity Test		
	Baseline	200% of Baseline
Average PV of Net CF	0.21%	0.24%
Percentiles		
1	-2.11%	-1.05%
5	-0.88%	-0.38%
10	-0.52%	-0.19%
25	-0.03%	0.07%
50	0.31%	0.30%
75	0.61%	0.47%
90	0.82%	0.63%
95	0.92%	0.71%
99	1.18%	0.82%

Now all of the things that we've talked about today make these problems look pretty difficult. They certainly are, but they're worth the effort, because I think insurance companies are going to offer these benefits. It's time the companies got serious about spending effort on risk management. I just want to tell one brief story. For one client, I spent some time going to Wall Street firms to find out how much investment banks would charge to take this risk off the hands of the insurer. There were two things that came out. First, they won't accept this degree of uncertainty. We've gone through all these different policyholder behavior features. They simply wouldn't touch them with a ten-foot pole. They also don't like the long-term options that are embedded in these kinds of policies. Even if you eliminated the uncertainty, they would still view these as extraordinarily long-term options. In their daily mark to market environment, with their view of their capital needs, they're just not going to accept that. Insurance companies can accept that because they're managed according to somewhat different principles. I think the point is that they can accept it as long as they have a good risk management system in place. So if you go through all this effort, do you understand what your risk position is? What are your plans for managing that risk so that it stays in an acceptable position? If you can formulate cogent arguments that you can present to analysts and rating agencies, then you can highlight that managing a portfolio of illiquid long-term options has a place within your company. You need to place that within the context of the company's goals in terms of managing your risk, getting acceptable return, and getting the growth that's going to lead to maximizing the shareholder value. For an insurance company, I think it makes sense to go through all of this effort, and that will have great benefits in terms of maximizing company value.

MR. BRUCE D. SARTAIN: I'm with Illinois Insurance Department and I have two questions, both on the GMDBs. You had said that the charges for those don't depend on which sub-accounts you're in. I think that's the same way for guaranteed living benefits. I'm wondering, are there any rumblings that this might change in the future? Or, are there just too many limitations to try and change that by sub-account? The second question is on reinsurance. A year or two ago, I think I heard that reinsurance market was no longer there. Reinsurers weren't reinsuring this. I wonder if that's still the case, and if it is, what are some of the reasons for that?

MR MUNGAN: On the first question, in talking with companies lately, one feature that companies are experimenting with is coming up with standardized asset allocation strategies that policyholders can choose. You might have a limited range of different asset allocation strategies. One, two, or three years down the road, we might see companies combine that with the GMDB. If you committed yourself to following a specified asset allocation strategy, the company would know in advance what the risk of that would be, and what kind of fees and benefits they could offer in terms of GMDBs. That might happen.

In terms of reinsurance, there's an interesting dynamic in the reinsurance market. Reinsurers saw that there is a benefit to offering products, but their risk management hadn't developed to super-sophisticated levels. They weren't able to actively manage the risk that they were taking on. But I think that's changing. The

reinsurers that I've talked to lately are discussing the possibility of getting back into the market, but their reinsurance products will be backed by hedging programs. At each point in time, they know exactly what risk they've taken, and they're managing that for future market fluctuations. I think you'll see potentially good news on both the product development front and the reinsurance front.

MR. DAVID FIHRER: I'm with Canada Life. I have a question for Marshall regarding the lapse rates that you discussed earlier. You said that you had a 1.5 % per month for all classes combined. Do you ever split between the Class A and the Class B?

MR. GREENBAUM: Yes, we maintain the database for our Class B shares since our financings are for that particular share class. The average for the Class B share is included. If you just back out the ratios, I don't know what that would be offhand. But you could probably derive something pretty reasonably.

MR. FIHRER: This is a rough split of what the portion is between the two.

MR. GREENBAUM: I don't know, but the A share obviously dwarfs the B share. I'm not sure specifically of the market volumes on that.

MR. CHARLES FREDERICK HILL: I'm with Tillinghast. I have a question for Marshall regarding the securitization as it would apply to variable annuities. I'm wondering if there's a difference in the legal issues. Say you have a mutual fund. Perhaps you can actually legally assign the claim on that revenue stream with the variable annuity. Perhaps this is a different legal environment. I'm just wondering if you look at that, and if it ends up being a general credit exposure to the insurance company as opposed to something that is really secured by the revenue stream.

MR. GREENBAUM: Obviously there are intricacies with doing this in the variable annuity product. I think you've pointed that out. There are accounting implications as well as legal implications in securitizing and producing that as good collateral. The mutual fund structures they are completely bankruptcy remote. We obtain ownership for all of those fees. That is not exactly the case in the mutual fund world. Obviously, there are ways to structure and then get it around those particular issues.

MR. ARI JOSEPH LINDNER: I'm with ACE Tempest Life Re, and I just wanted to help answer the earlier question about whether there was reinsurance market. Yes, there are at least two reinsurers. I won't hog the whole stage here, but there are at least two reinsurers actively writing death and living benefit risks.

FROM THE FLOOR: I'm not sure about the exact number, but it was historical average from I think '73-'99.

FROM THE FLOOR: Do you have a guess?

FROM THE FLOOR: I wouldn't even venture to guess.