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SESSION 8PD

NEW FRONTIERS IN ASSET/LIABILITY MANAGEMENT

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NEW FRONTIERS IN ASSET/LIABILITY MANAGEMENT

MR. FREDERICK W. JACKSON: Jay Glacy is senior consulting actuary at Ernst & Young LLP. He has been doing quite a bit of work for them on asset/liability management. I knew him when he was an actuary at Security-Connecticut. He plays a major role in the asset/liability management (ALM) projects for Ernst & Young. He's a frequent speaker at these types of sessions. Doug George is the Partner at Avon Consulting. He also is a frequent speaker at these meetings, and he plays a lead role for his firm in its numerous asset/liability management consulting assignments.

This is a subject very near and dear to my heart. Asset/liability management is really synonymous with dynamic financial analysis—which is really quantitative risk management. The property and casualty (P&C) arm is picking up dynamic financial analysis (DFA) as a quantitative analytical tool. It's an evolving art and science. The *Dynamic Financial Condition Analysis (DFCA) Handbook* was the first piece of literature that tried to pull this science or art together. It's intended, at any given time, to reflect contemporary knowledge and practice. The handbook gets revised regularly. The exposure draft on the ALM Principles Task Force takes a step back. It consists of a lot of people who are actually practicing ALM, and it takes a step back to look at the principles and specifically avoids addressing practice.

Asset/liability management is the ongoing process of formulating, implementing, monitoring, and revising strategies related to assets and liabilities in an attempt to achieve financial objectives for a given set of risk tolerances and constraints. Specific mention of practices is avoided there. This session addresses practice, and Jay and Doug are going to be discussing the new conceptual tools or the current conceptual tools that they're using. Some of those tools are value-at-risk, optimization techniques, and holistic ALM. One area they're not going to cover is some innovative investment return measures like custom-based or liability-based benchmarks or modified sharp measure, which I think David Becker is pushing. In the modified sharp measure, you focus on downside risk rather than variance. There are a lot of areas that are being covered. Before I get out of the way, I would just ask you to consider the principle draft that's out there. I emphasize that there's no one right way to do ALM or DFA work.

The two folks that are going to be discussing how they do it have very explicit ways of practicing ALM. There are some slight differences but there are very real similarities in the way they're doing their work. You should be clear on the method—the menu of concepts and tools that you can choose from. Then, if you're not already, you should start with clear direction or get help constructing a company-specific risk management process in the concepts, tools, and systems available.

MR. ANSON J. (JAY) GLACY, JR.: First, I'd like to review what I see as the six keys to an effective ALM process:

- Senior management commitment
- Coordinated and disciplined approach
- Well-defined measurement framework
- Leverage from CFT platform
- The reparative power of derivates
- An action and maintenance plan

Without a doubt, the first key is securing senior management commitment and sponsorship. For my remarks, it's the fourth key—leveraging from the cash-flow testing platform, that will be the springboard for the sophisticated types of analyses that I'll discuss.

BEYOND DURATION

First, what can we say about our old friend *duration*? Has he outlived his usefulness? Obviously not. I know that we all continue to use the term *duration* in our daily parlance. As a matter of fact, I probably don't go an hour, certainly not a day, without using that word. I would venture to guess that in every insurance company investment policy statement you'll see that word. However, it does have some shortcomings, one of which is multiple definitions. I jotted down a list of the different varieties of duration that exist. I know that everybody here can probably add to the list, but let me just recite the ones I came up with. There's *partial duration*, *key-rate duration*, *modified duration*, *McCaulay duration*, *effective duration*, and *option-adjusted duration*. On the other side of the

balance sheet, since the market value of liabilities is not well-defined, neither will be the duration of liabilities. However, there's a lot of activity within the actuarial community right now addressing the market value of liabilities.

Duration neglects a number of dynamic elements that are important in risk management. First is what I call *forward flows*. Forward flows is shorthand for renewal premiums from business on the books, as well as premium dollars arising from future new issues. Duration also neglects the effects of reinvestment as well as what I term holistic effects, which refer to the interplay and risk synergies that exist among different product lines. Finally, duration ignores the distribution of value. It's a point estimate that tells you little about the overall risk profile. By contrast, value-at-risk also is a point estimate, but it tells you a little bit more about risk than duration does.

There are some new metrics, some of which aren't so new anymore, making their way onto the scene. There's earnings-based measures, option-adjusted value of distributable earnings (OAVDE) value-at-risk, dynamic approaches and holism. There are some other acronyms that you can probably add to the list like EVA, or economic-value-added. But most prominent on the list is without a doubt value-at-risk (VAR). I will not be discussing value-at-risk in my talk. There are sessions at this symposium devoted to VAR that explore the topic thoroughly. What I will discuss, however, are some new techniques for pursuing optimality in risk management.

TOWARDS OPTIMIZATION

So, what are the first steps in the journey towards optimization? What I'd like to do is move beyond "rule-of-thumb" management and utilize some advanced financial techniques in conjunction with operations research methods and some derivatives. All the tools in the tool kit will be rolled out. First, let me explain what I mean when I distinguish between *maximization* and *optimization*. *Maximization* is, in my definition, just what it seems. It's the maximizing of some short-term-oriented quantity. In the insurance company setting, that might be quarterly earnings. *Optimization*, on the other hand, focuses on long-range strategies and the building of wealth.

The key to optimization is that it considers intertemporal effects. That's shorthand for saying that optimization considers the effects that management decisions taken today can have on the latitude you have to make such decisions tomorrow. In addition, subjective considerations like utility, or the balancing of risk and reward, can also be considered within an optimization framework. Optimization allows you to set your model in motion and consider dynamic policyholder and insurer behavior as well as reinvestment activity. It reflects forward flows, which are renewal premiums arising from business on the books and premiums from future new issues. The bottom line is that optimization focuses on maximizing wealth.

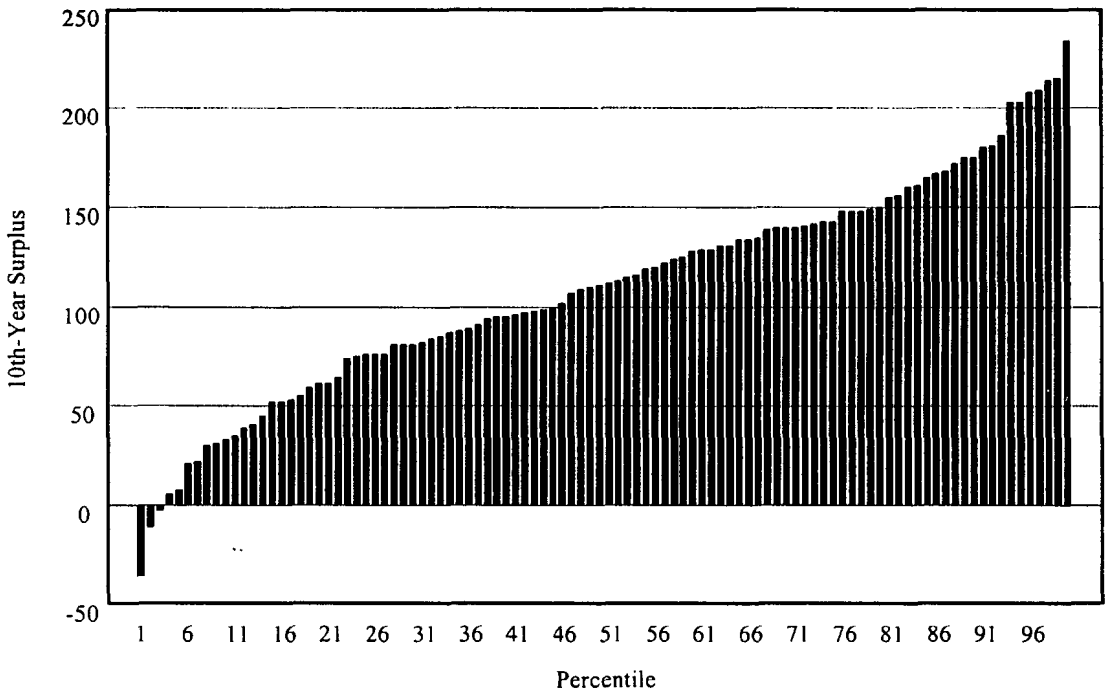
Let me return to that intertemporal idea for a moment. I have a little thought-experiment that I sometimes do that illustrates the concept. Every company that issues single premium deferred annuities (SPDAs) probably goes through the following exercise on a regular basis:

In a conference room a marketing person, an investment person, an actuarial person and a financial person all gather to set the SPDA renewal crediting rate. Typically, these people will look at some numbers, shuffle some paper, trade fisticuffs, and at the end of the hour, out will come the renewal rate. They know implicitly that setting the renewal crediting rate at a "high" level helps to dampen current-period lapse activity. By the same token, high renewal rates also work to increase the ultimate liquidation or maturity value of the contract. By contrast, a "low" renewal rate limits the growth in liquidation values but at the cost of accelerating current-period lapsation. There's a fine balance here and hopefully the people in that room who make the decision about renewal crediting rates will choose the "optimal" rate, but that's usually not the case. My belief is, that in making these types of intertemporal decisions, you want to choose the rate so that you'd keep the policyholder just happy enough so he or she will continue on with the policy until next month, next quarter or next year.

Chart 1 is a risk profile curve (RPC). This is the single most powerful depiction of risk and return that I know of. It is the result of a stochastic analysis based on hundreds of thousands of scenarios whose outcomes are rank-ordered from lowest to highest and then condensed down to 100 representative outcomes. I like to use a financial metric that has immediacy and relevance in the

management ranks—one that they have a feel for, or something that's related somehow to quarterly earnings or to the performance of the share price. In this case I used the value of 10th year surplus. The reason that I boil it down to 100 percentiles and then graph it as 100 "buildings" is because it allows one to make some nice probability statements about outcomes. So, in this case it looks like there's a 10% chance that 10th year surplus will be below $30. By the same token, you could look at the other end of the RPC if you like. The other nice thing about a risk profile curve is that one look at the steepness of the individual buildings that constitute the curve gives you an immediate feel for the level of risk present. If you construct the risk profile curve correctly, each of those 100 buildings is equally probable. So this looks like a pretty risky line of business. In contrast, flatness in the buildings would tell you that there's minimal risk in the business at hand.

CHART 1
Towards Optimization
Risk Profile Curve
100 Ordered Stochastic Outcomes



One important step in our move towards optimization is to select an objective function. The risk profile curve illustrates one example of an objective function you might choose to maximize the 10th-year book value of accumulated surplus. There are a number of others you could choose, each with its own advantages and drawbacks. The reason I usually like to choose a 10th-year value is because it's sufficiently long to capture a full range of financial market dynamics, but it's not so long that it makes the decisions that you make today inordinately dependent on distant events. The optimization process also requires some constraints and the definition of a risk measure. The constraints include minimum contractual guarantees and restrictions on annual movements. There are two different risk measures you could employ, but you can choose your own. The standard deviation of 10th-year surplus is an obvious choice. For a different flavor, you could look at the squared second differences of yearly GAAP earnings. That gives you a feel for how smooth reported earnings will be.

Once again, by using the SPDA context, the insurer really only has two primary levers to manage both risk and profitability. Those levers are the reinvestment maturity of assets and the strategy that the insurer uses to declare renewal crediting rates. So, in this simplified framework, I've distilled those two levers down into two very simple strategies. For the reinvestment strategy let's assume there's 11 choices, zero to 10 years, where zero means holding 90-day's cash. The renewal crediting strategy I've shown is nothing more than a linear combination of the new-money rate and the insurer's portfolio rate. I've discretized it into 11 different choices. Alternatively, as I mentioned before, you could also back into a renewal crediting rate, which keeps the policyholder just happy enough to hang on to the policy. So, with these two levers you would conduct an enumeration experiment, setting up a table of 11 x 11 which equals 121 outcomes for each combination of reinvestment and renewal crediting choices. Each entry in the table would be the expected profitability paired with its associated risk measure. The resulting 3-D surface graph of outcomes would provoke some nice discussion about utility and the balancing of risk and return.

What are the key features of an optimization approach? As I mentioned before, setting the model in motion is critical. So is adopting a dynamic framework, both in regards to policyholder behavior as well as in reflecting forward flows, the applicable reinvestment strategy and the associated

renewal crediting rate strategy. In addition, business scenario alternatives are critical. Rerun your analyses based on worst-case, best-estimate, and rapid-growth production scenarios because the anticipation of liquidity in the form of future premium can dramatically change the risk-versus-return decisions that you make today.

AN OPTIMIZATION CASE STUDY

Now that I've set the stage let's get to the beauty part, an actual case study of how this might be implemented. Since I'm going to use some derivatives concepts here, I'd like to paraphrase a quote from a Nobel Prize-winning economist by the name of Robert Merton. He said the following: "If you're not using derivatives, you're gambling with shareholders' equity." So, let's use some derivatives. The optimization process here focuses on earnings as opposed to value. What I'm going to illustrate through the use of operations research techniques is how to re-sculpt or re-contour the earnings profile. I'll use derivatives not to create wealth or to speculate, but to "transfer" value from some interest-rate states of the world to others, and from some model years to others. To do this, I'll use interest rate caps and floors. Why caps and floors? First, there's no option-exercise decisions to model with caps and floors. You buy them, and they pay off or not. Just briefly, an interest rate cap is a long-term contract that pays off if and when interest rates exceed a certain strike level. Conversely, a floor contract pays off if interest rates go below a certain strike level. They're available out to 10 years, with best liquidity out to three or four years, and they feature minimal counterparty risk. The long-term nature of caps and floors is a key feature for this optimization.

With these interest rate caps and floors, I'm going to construct something called a *self-funding collar*. A self-funding collar is nothing more than an optimal mix of caps and floors of different expiries and strike levels. However, I'm going to go both long and short contracts, which means that we're going to buy *and* sell interest rate caps and floors. (From a practical standpoint, note that the sale of caps or floors is problematic.) In addition, I'm going to simulate deferred caps and floors through simultaneous transactions. For example, I'll simulate a five-year cap contract deferred five years through the purchase of a 10-year cap and the sale of a five-year cap.

Next, I'll select the five-year Treasury rate as our key rate. Some statistical analyses of the insurance industry have found that the five-year Treasury is highly relevant in both management and policyholder decision-making. I'm going to model accounting-based quantities. The difference here, as opposed to most optimizations that you may be familiar with, is that I'm going to focus on quantities that have real relevance and immediacy for chief financial officers (CFOs) and CEOs. These people relate naturally to accounting-based quantities, like quarterly earnings, because earnings drive share prices and that's how they get paid. Finally, the reason a self-funding collar is self-funding is because there's no up-front cost. How do we do that? We structure the mix of interest rate caps and floors at the beginning of the model so that the ones you buy are precisely equal in value to the ones you sell. That way the upfront cost of the structure is zero.

For the optimization process, I typically use either linear or quadratic programming, two of the tools from our operations research tool kit, together with an array of constraints and an objective function. Some possible objective functions include: tightening, which is minimizing standard deviation of year 3 earnings; maximizing the smallest yearly earnings; or smoothing, which is minimizing the standard deviation of all year earnings. We will look at the graphical results to describe these further. For the optimization itself we've had moderately good luck with the Solver tool that's in Excel. Sometimes it misbehaves and is very sensitive to starting values. We've had better luck with some of the commercial packages, like What's Best, which appears to be a bit more stable.

The engine of the model for this optimization is an interest rate process or algorithm. Chart 2 is a lattice of the five-year Treasury rate, our key rate for this discussion. It's based on the well-known Black-Derman-Toy interest rate algorithm which is becoming common in actuarial use today. The lattice shown is actually a subset because I've pruned it a little bit. Near year six, there are a couple of nodes missing at the top and bottom. This is usually done to make the actual modeling and optimization feasible in a real-time setting, but with the speed of computing machines that exist today, it's possible to use the full lattice if you desire. I think the commercial actuarial software—PTS and TAS—both have some pretty good interest rate generation algorithms in them. I don't know about some of the other newer software packages. You can easily see one feature of the Black-Derman-Toy algorithm in Chart 2. That is its lognormal nature—how movements in rates are proportional to actual rate levels.

CHART 2
Five-Year Treasury Lattice (Subset)

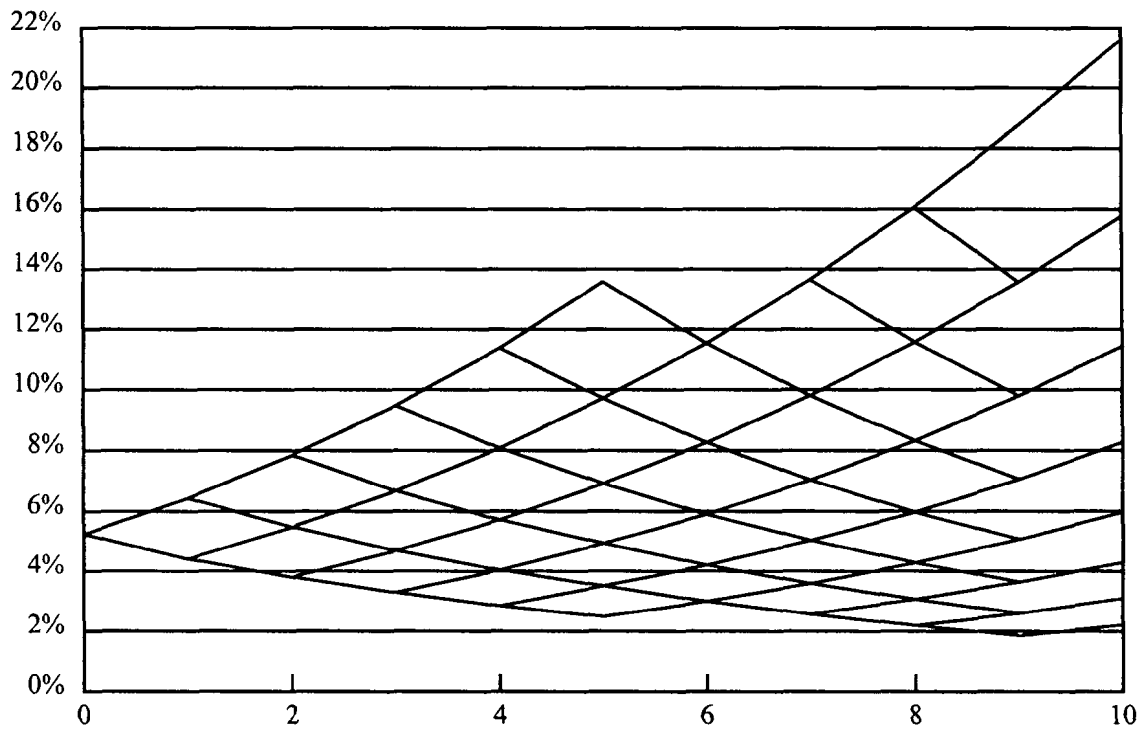


Chart 3 depicts model results for the control experiment, before the application of self-funding collars. I apologize for scaring you with this picture. This always looked to me like the creature from the movie *Alien*, and that's probably a pretty good indication of the nightmare that this is. Chart 3 is a "spaghetti diagram." Very simply, a spaghetti diagram is a depiction of 100 or 1,000 different strands of potential future earnings streams—one for each interest rate scenario. I think you can see that some of the loss situations where earnings are really bad are probably due to high interest rates. Let's see how we can fix this.

CHART 3
Emergence of Earnings: Control

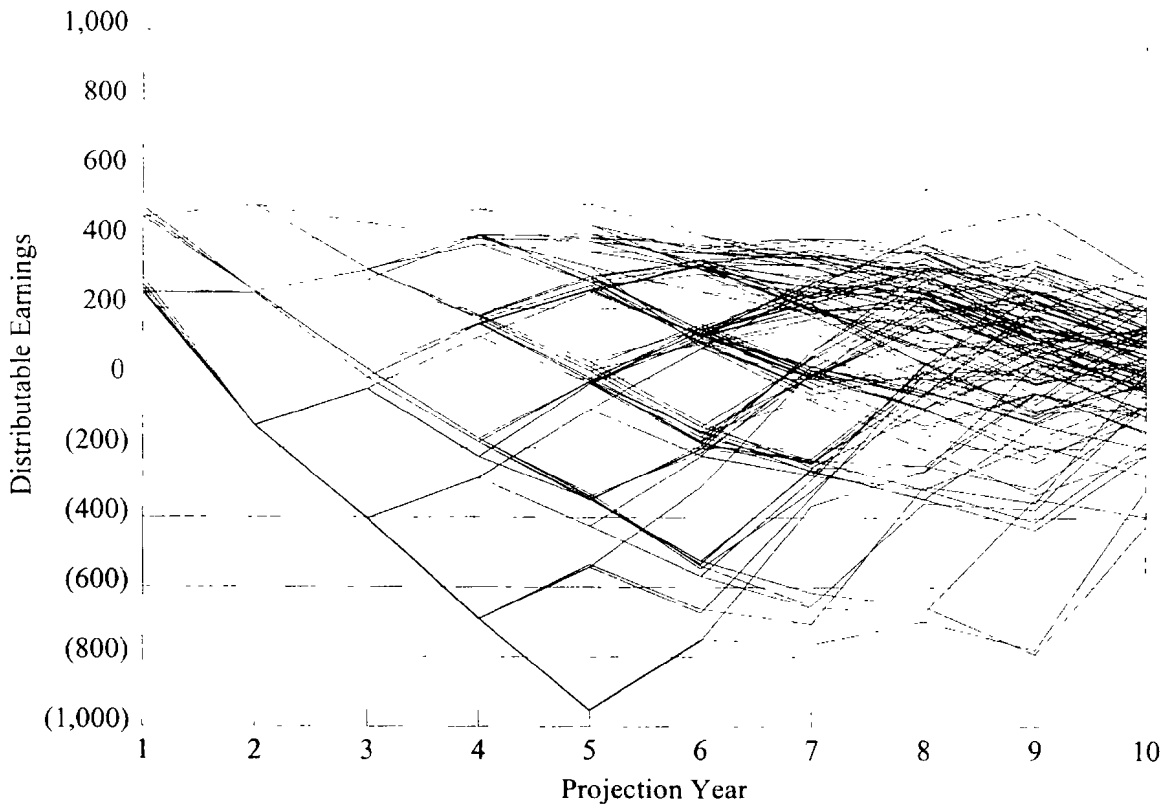


Chart 4 depicts results after the application of our optimization routine using the self-funding interest rate cap and floor approach. These results are based on an objective function which I call "maximin". That's shorthand for telling the optimizer, (for example, the Solver routine in Excel), to maximize the smallest of the earnings in any model year on any scenario. That's what it has done, and it seems to have done quite a good job of it. The greatest loss that I can see by just eyeballing the graph, looks like about $100. Again we're using the self-funding collar approach with long and short caps and floors. It can't create value, but what it can do is move resources around from different interest rate states to others, and from different model years to others. What's happened here is that the optimizer has pulled value from good scenarios in good years and used it to offset the bad years.

CHART 4
Emergence of Earnings: Maximin

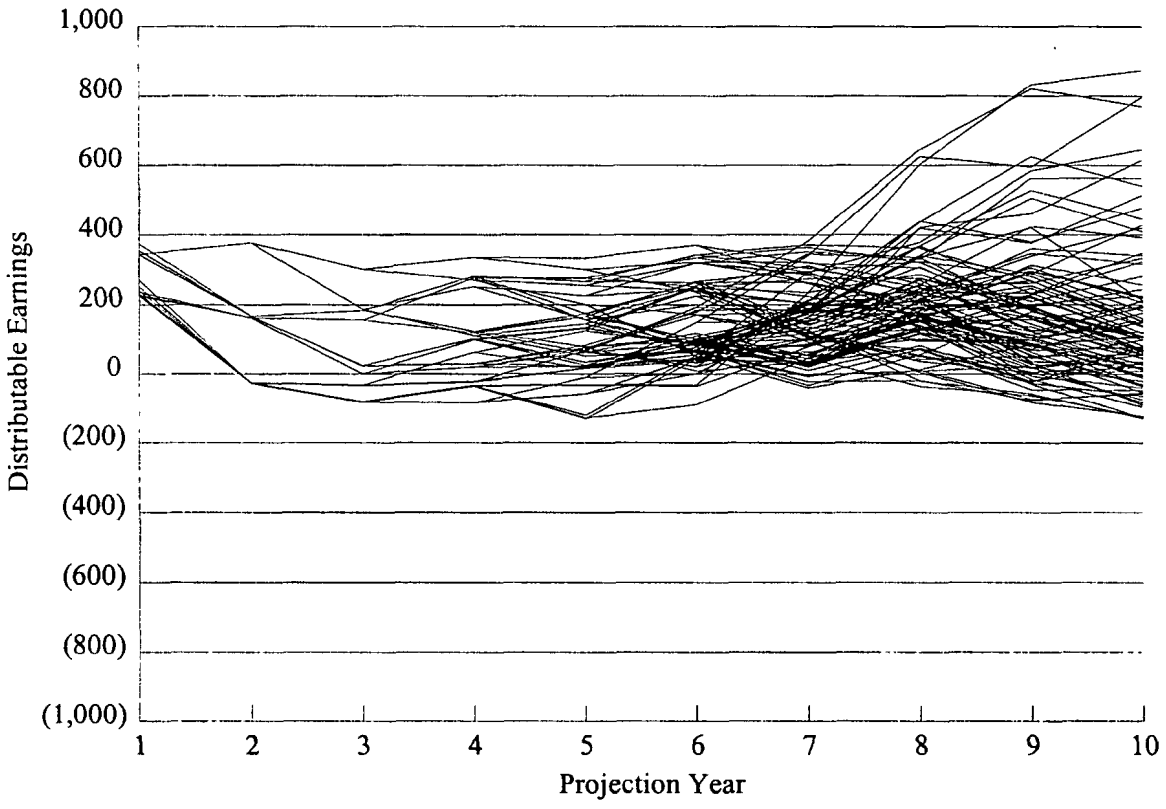
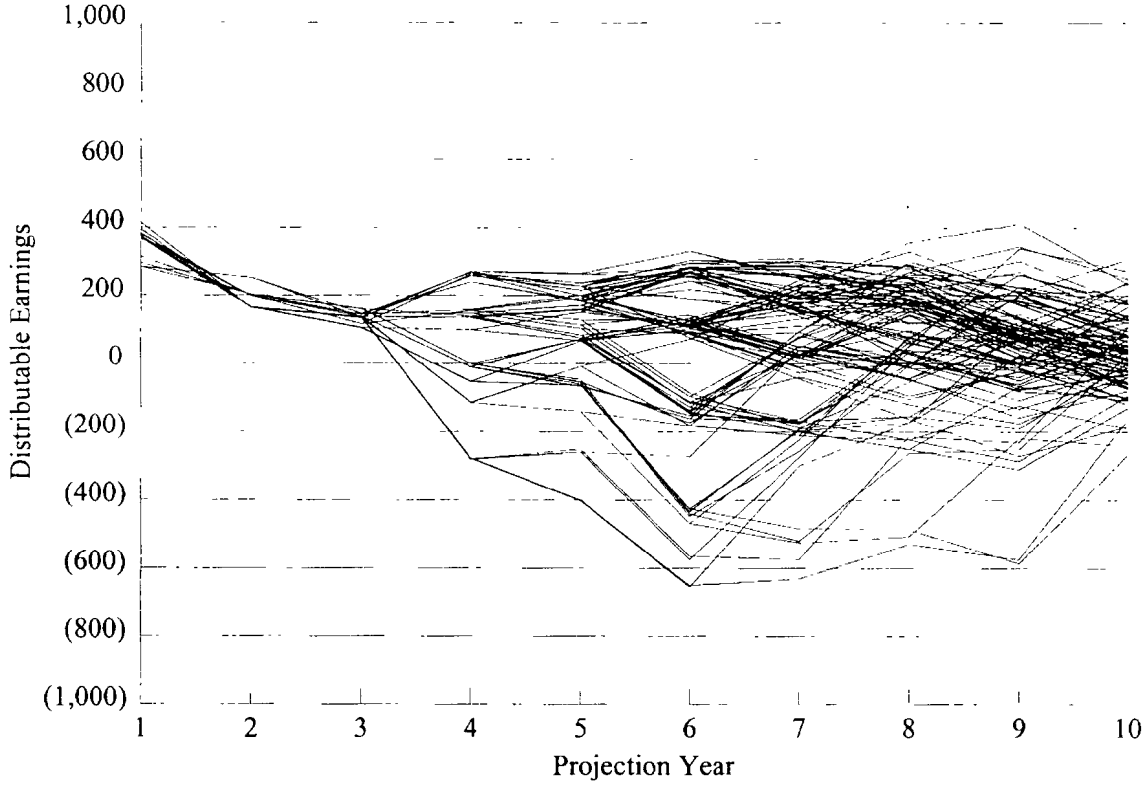


Chart 5 depicts an objective function called "tighten." Tighten might be employed by an insurance company that was contemplating some sort of recapitalization in three years and wanted to ensure that its earnings at that time were rock-solid no matter where interest rates went. The actual objection function used here minimized the standard deviation of year-three earnings.

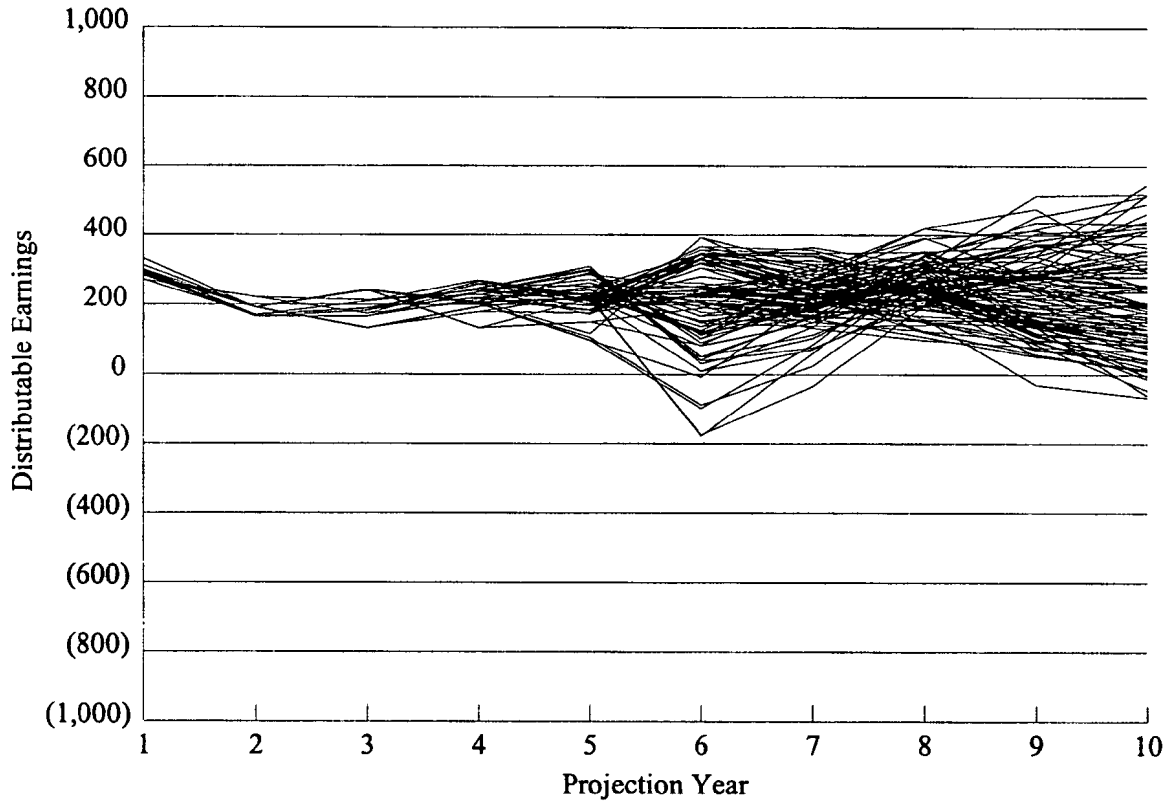
CHART 5
Emergence of Earnings: Tighten



The last objective function is one I call "smooth" and is actually the one that looks the best (Chart 6). The objection function here was to minimize the standard deviation of all years' earnings in all scenarios. Chart 6 shows that it had a bit of trouble in model year six, but that could be due to the pruning of the lattice that I mentioned earlier.

Two caveats are in order at this point. First, any use of derivatives to purposely misalign revenues and expenses is not advisable. Second, anyone who has toyed with the Solver routine knows that it hones like a heat-seeking missile into arbitrage profits and, ultimately, into results that are totally ludicrous. The way you solve that problem is by making your model tight and consistent so that there are no inconsistencies between the pricing of derivatives and the interest rate scenarios you use for the modeling itself. In addition, the accounting framework itself, since we're optimizing accounting quantities, can create optimization anomalies.

CHART 6
Emergence of Earnings: Smooth



HOLISTIC ALM

The final section of my remarks pertains to holistic ALM. Holism is an odd word and I'm not really quite sure what it means. I've been told it means "wholeness" or "oneness." The way I illustrate the concept is to observe that to get the best look at a building you don't stand 12 inches away from it. You move back to see the "big picture." And that's what holism is all about. The goal of holism is to measure and manage risk and return at the total-company level. The benefits of a holistic approach to ALM are that it provides a comprehensive, bird's-eye view. Holism also precludes line-of-business redundant activities, and I have a good example of that:

> There's an apocryphal story that I've told before about two portfolio managers working at the same insurance company. One day they met for lunch in the lunchroom, and Portfolio Manager A said to Portfolio Manager B, "Boy, I solved my risk problem today in my portfolio. I went long Dutch guilders." He was pretty

> happy. Portfolio Manager B said to him, "What a coincidence. I solved *my* risk problem today. I went short Dutch guilders." So, they did some backslapping and some high-fiving and then went into the CIO's office and demanded a big raise. I think you can see what the problem is with this story. That, in a nutshell, is what I mean by the line-of-business redundant activities that holism seeks to attack.

Holism, at its essence, exploits the natural internal synergies among product lines, and that is its key feature. How does Product Line A work to soak up risks that might be in its sister lines? That's something that in a holistic context you want to try to exploit and maximize. Holism also helps motivate strategic line-of-business decisions about whether you want to get into or out of a particular product line. How does Product Line B, that you might be contemplating entering, relate to Product Line A? Would it act as a diversifying hedge or would it exacerbate risk positions? For the corporate risk manager, holistic risk management is nothing more than a big netting exercise. You take all the product lines and all the statutory entities, net them out and see what drops out. Whatever sticks out, that's the thing you fix.

Table 1 is a very simple illustration of holistic ALM in action using made-up numbers. I've illustrated two product lines, A and B, and I've computed each market value of surplus in various interest environments. On a stand-alone basis, Product Line A has some obvious problems in up-interest scenarios that might be solved through the use of short Treasury futures. Product Line B has a similar problem in down-interest scenarios, but when you combine them, is there really a problem and should any risk management actions be taken?

TABLE 1
Holistic ALM—Illustration

Interest Rate Shift	LOB A MV of Surplus	LOB B MV of Surplus	Combined MV of Surplus
–3%	140	(20)	120
–2	150	40	190
–1	120	75	195
0	100	100	200
+1	60	130	190
+2	20	160	180
+3	(40)	180	140

At its core, holistic ALM relies on the important concept of cornerstoning. A cornerstoning product line is one that does double-duty or triple-duty in risk management. Let's discuss some illustrations that are probably pretty familiar to you. For instance, single premium deferred annuities (SPDAs) and single premium immediate annuities (SPIAs) are natural internal hedge partners. Why is that? The price of entry into the SPDA marketplace is that your assets must be longer in duration than your liabilities. In the SPIA world, the duration of liabilities can be very long and usually it's difficult to find assets of comparable length. Adding the two lines together is a holistic solution. With universal life and SPIAs you have the same natural hedge for mortality risk. With universal life, the insurance company suffers upon premature deaths. With SPIAs, it's just the opposite. So SPIAs, structured settlements or other on-benefit annuities are wonderful candidates for cornerstoning. Why is that? Because they can help you solve simultaneously, through internal means, both your mortality risk exposure and your interest rate risk exposure.

So these are the type of strategic line-of-business decisions that holism motivates. It's an aggregation mechanism that nets exposures out across product lines, across the balance sheet and across time. And here's where our old friend forward flows enters the picture. In the holistic setting, it's important to anticipate the future premiums arising from existing business as well as from new issues. Thus, anticipating the liquidity effects of such forward flows can help you extend out on the yield curve and pick up incremental yield.

There are typical implementation issues that practitioners face in pursuing holistic approaches. You'll need a common analytic platform to support your modeling. I know the PTS corporate model does a pretty good job in this regard, but I'm not too sure of the capabilities of TAS. Capital market conditions, strategies, and assumptions all must be connected across the lines of business. What's most important is to have a good, strong dose of model integrity. I also usually recommend that a "helicopter pilot" be assigned to the holistic exercise—someone who can hover above it and spearhead the whole exercise.

There are implications in the financial management arena that arise from holistic risk management. As you might expect, a holistic view combines nicely with financial planning, capital budgeting and

other activities in the financial area. One key benefit of holism is that complementary product mix combinations require less economic capital. What do I mean by that? The risk offsetting effect among product lines that holism conveys implicitly converts economic capital that you might otherwise need into cosmetic capital. It's a very nice thing to do. Holism also contributes to the stabilization of earning patterns. That too is one of its main goals. Another consequence is raising the share price, but I'm not too sure about that these days. It's commonly held in business schools that the market doesn't reward you for risks that can be easily diversified away, which is what holism is all about. Finally, with holism you can avoid troublesome derivatives contracts or reinsurance treaties because some risk management problems can be handled through holistic solutions. That's the whole goal.

WHAT LIES AHEAD?

Listed below is what I believe lies ahead for ALM.

- Global and financial convergence
- Drive to fair-value accounting
- The advent of VAR
- Product/investment innovations
- Demographic effects
- Dramatic advances in computing technology
- Continued capital market volatility

While we're sure of continued capital market volatility, my own particular belief is that demographic effects will dominate in the coming years. I usually say that demography is destiny. I'd be very interested in your perspectives and thoughts about the future of ALM.

MR. DOUGLAS A. GEORGE: Let's start with the definition of asset/liability management, and this comes from the SOA task force that was put together to explore the principles of ALM. It's important to one of my first points. "ALM is the ongoing process of formulating, implementing,

monitoring, and advising strategies with assets and liabilities in an attempt to achieve financial objectives for a given set of risk tolerances and constraints." A couple of subpoints are found later in the text: "Risk is the exposure to a potential outcome that has an adverse financial impact. For insurance and other financial institutions, risk is an inherent part of doing business." Finally, there's a definition of risk tolerances: "Risk tolerances are organizations' attitudes toward risk, often expressed as the acceptable amount of a specific risk, given potential expected outcomes."

I agree with most of what has been put together by this committee, and especially with these points. My own definition of ALM that follows from here is "asset/liability management's goal to optimize the financial risk/reward profile of the firm." An implication of this is that there is a trade-off between risk and reward in that if we want to achieve a higher expected return, we do so by taking a higher expected risk. If we need to lower the amount of risk we're taking, we lower the expected return that we're willing to accept.

All of this is nothing new. We've heard these concepts for a long time now, but what gets me real confused is when we start talking about duration matching. So many of us seem to talk about it as if it's the objective function—as if it's the function of that our firms are really out to meet. So many times you hear, "If we match the durations of our assets and liabilities, then we'll be in good shape." I disagree with this. I really don't see this as being the primary objective function. A further extension of this is the concept of immunization. Much of the theory that we have today and what you see written, revolves around the theory that immunization should be the objective function for our companies. I disagree. I really feel that immunization is impossible for us, given all the risks that we take—not just asset/liability risk but all the different risks we take in our products. That would include the credit risk in our assets, the regulatory risks, and the general business risk among others. I think the whole concept of immunization is just an ideal that we really shouldn't be shooting for.

Let's get back to duration matching. Jay mentioned a few problems with duration. There has been a lot written lately as to duration problems. For example, what discount rate do you use for the liabilities? How do you treat future premium? Jay mentioned the different definitions. One duration matching misunderstanding is McCauley/modified.

If you have options in your assets and in your liabilities, a McCauley or a modified duration just isn't going to provide a proper duration. You really need an effective duration. There's this whole idea that if we're duration matched, we're fully hedged. When it comes down to it, if you are duration matched, you could be fully hedged or close, to the extent that that might be possible. On the other hand, you might not be hedged at all. You might have a large convexity mismatch or even a key rate duration mismatch so that you are taking risk in reality.

But having said all this, the duration matching and the duration part of the calculation is not where I think the real problem is. The real problem, I think, is in the idea of the matching. I don't care if it's duration matching or cash-flow matching or immunization. These concepts imply that we shouldn't be taking asset/liability risk, and I disagree with this. If you think about it, we could "match" on all the different risks of our business. We could match mortality risk. We could go out and sell term policies and reinsure 100% of the business. But do we do that? No, because we know we're not going to make money doing that. What we do with our mortality risk is we decide what's an acceptable level of risk for us. We set our retention at that acceptable level, and we reinsure the excess. The same theory should apply to all our risks. You find the acceptable amount of the risk that you're willing to take. You expect a bigger reward because you take that kind of risk, and you match or reinsure or hedge away the excess.

Let me give you a quick example as to why duration matching or even cash-flow matching, for that matter, is not optimal under most economic conditions. Chart 7 shows the average yield curve over the last 10 years—from 1987 to 1997. Chart 8 shows the implied short-term forward rates under that yield curve. The shape looks the same, but it's definitely a different curve. Chart 7 was a yield curve and Chart 8 is just a short-term rate graphed through time. Every yield curve has an underlying interest rate prediction in it, and this is the interest rate prediction that is implied by the yield curve in Chart 7. What it says is if interest rates moved in this manner in the future, then it doesn't matter how we invested along that yield curve—we could go long or short. We would still expect the same return over time.

CHART 7
Average Yield Curve (1987–97)

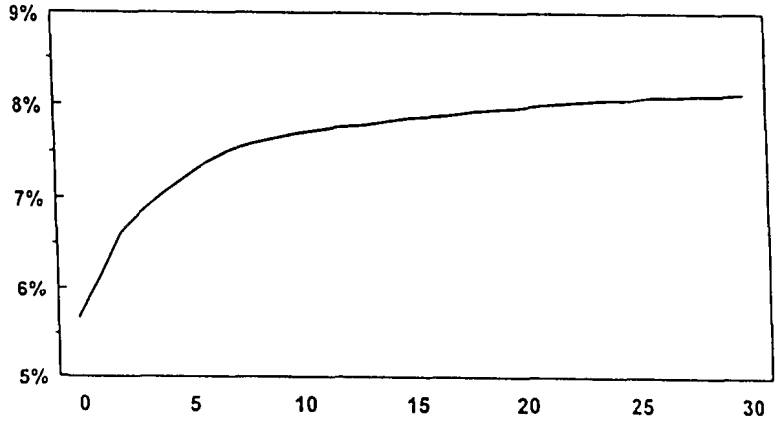
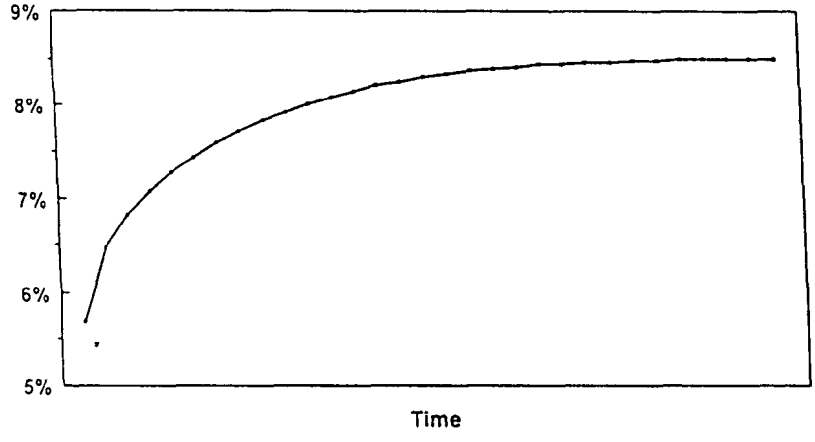


CHART 8
Implied Short-Term Forward Rates



For example, say we want to invest out for 30 years. We could go out and just buy the 30-year bond, or we could buy a succession of 30 one-year bonds over the next 30 years. If the yield curve or the short-term rate moves like this over that time period, then at the end of the 30 years, we will achieve the same total return. Well, what does this mean?

Before I get to that, let's identify some rates that underlie those two curves (Table 2). The first one, the 6.14%, is the one-year spot rate underneath the average yield curve. The 6.62% rate is the two-year spot rate. If you put those together, they imply a one-year forward rate one year from today of 7.1%.

TABLE 2
Rate Relationship

Term	Spot	Term	Spot	Forward
1	6.14	2	6.62	7.10
2	6.62	4	7.07	7.52
3	6.87	6	7.40	7.94

What does this mean? Let's say you have a one-year liability. You have a cash-flow that's due in one year. You have two choices. One is to invest long. I could invest in the two-year rate, or I could invest in the one-year rate and match that cash-flow. What should I do? Say you go to the two-year rate and take some duration risk. Say you take a little cash-flow risk and invest in a two-year rate rather than the one-year rate. Four scenarios can happen.

The first one is rates could drop below the 6.14%. The yield curve could come down. In that case you're a big winner. Because you've invested long, you not only have a higher rate through that first year, but you also have a capital gain that you're sitting on at the end of the first year when that liability comes due.

In the second scenario, the rates stay level at 6.14%. That's also a winner because, again, you're getting that 6.62% rate through the first year. At the end of the first year, you still get a capital gain because, at that point, the one-year rate is still 6.14%, and you have an asset that pays 6.62%. You still get a capital gain even under a level scenario.

In the third case, rates could rise up to 7.1%, which is the one-year forward rate. Again you win. For example, let's say the rate goes up to 6.75%. If you invested at the two-year rate, you get your 13.68% return. If you invest first in the one-year rate at 6.14%, and then the rates rise up to only 6.75%, the total return over that time period is 13.30%. You still won by going along, even though that rate has moved against you. In order to lose, you have to have case four in which rates rise past the 7.1%. In the example, they rise up to 7.5%, and you can see that if you invested in the one-year rate and then followed it again at 7.5%, you would get a higher return over the two-year period. This is a simple example as to how you can benefit by taking asset/liability risk, and how you can expect to achieve, on average, a higher return, although you are certainly taking a higher level of risk.

Having said that, this game is a lot tougher to play today. Right now we have a flat yield rate curve environment, and the benefits of these examples aren't nearly as great as what I've shown. However, the curve will steepen at some time in the future. I don't see it staying flat forever, and that's the time to get back into playing this particular game. Furthermore, this same argument can be made for all different types of risks that we take. Now isn't the time to go out and take big duration risks, but it could be time to be taking other kinds of risks, like more convexity risk and more quality risk, or some other risks that I see people doing today because they can't play the duration risk game as much as they used to. This demonstration works for duration, and it's easy to show because duration is easy to demonstrate. The same relationship exists for all the different types of risks that we take. So, even though we have a flat yield curve today, it doesn't necessarily mean we change the way we do business.

The real goal, given that we can expect to get a higher return with a higher level of risk, is to find the right risk/reward profile. I've run into people who should be taking more risk because they're not getting a high enough return and they really aren't taking that much risk in doing so. They

probably should increase the amount of risk they're taking. I have rarely found a case where a full hedge is the optimal position, in which it just hedges out your asset/liability risk completely.

I'm going to give you a case study to show how I go about finding that right risk/reward profile, and what it boils down to is stochastic analysis. I've been using this for a long time. I always go back to it because it works. I've tried so many different techniques, especially the new ones that come out. Many of them are very powerful, but I find most of them have flaws. Even though the stochastic approach isn't perfect, I find it's the best way to really understand the risks that you have. It helps you to really get a good picture of how they work and understand what you have on both sides of the balance sheet.

In this case, we have a life company. This was a case that I did a year or so ago now, so I might be a little rusty. This company was a regional player. It just operated in a small regional area with a very loyal distribution customer base which sometimes goes hand-in-hand with being regional. It's a very recognized name. Many of the agents had stock in the company. The field force was very loyal. Product mix was pretty similar to the industry average. The recent surge in deferred annuity sales is similar to what a lot of us have seen over the last 10 years, or at least up until a couple of years ago. This company was very surplus rich; it had something on the order of 25% or 30% of liabilities surplus. They had a lot of surplus to work with. Their dividend and interest crediting in-force management was strictly portfolio-based.

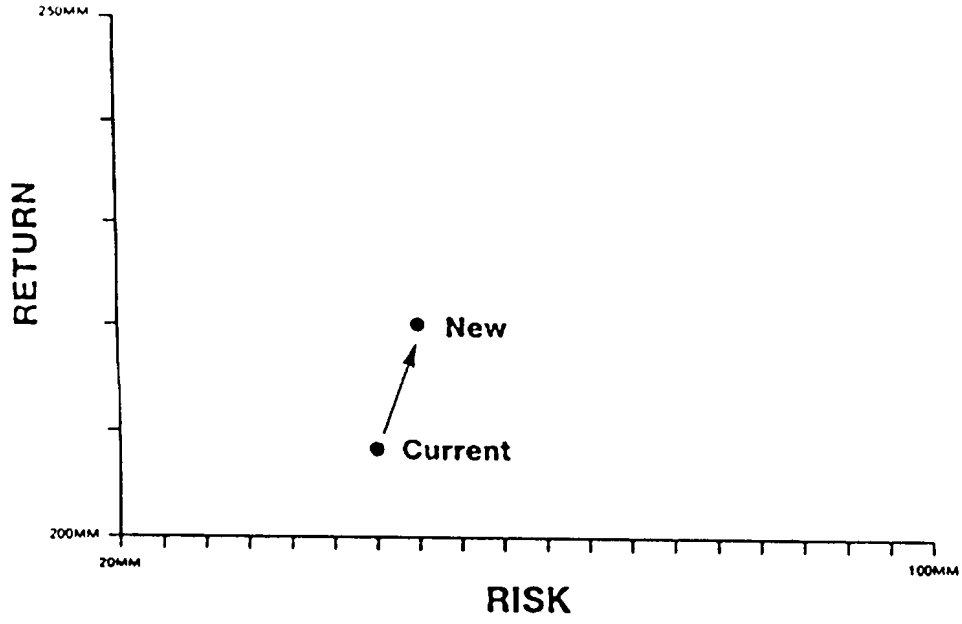
As for the asset mix, they were heavily invested in corporates, and the corporates were duration matched. They did not want to take much duration risk—9% was in Treasuries. They had some subsidiaries that were worth 13%, a large portion of callable agencies at 18%, and very small mortgage-backed securities (MBSs) and collateralized mortgage obligations (CMOs). The company had gotten burned six-or-so years ago with prepayments, and it wanted to stay away from them. It hadn't been into the mortgage-backed or CMO market for quite some time. It had a small amount of unaffiliated stock too.

When I looked at their portfolio, without even doing any analysis, the two things that jumped out at me were (1) divest the agencies, and (2) reduce the governments. The callable agencies are so efficient. I mean these things get called the minute that they should be called from an economic standpoint. They become an investment for insurance companies that you want to reconsider. The agencies know when to call these things, and you're not getting much of a spread for the call risk that they present. My advice to them was divest of these. You're not getting a good enough return for the risk that you're taking with this asset. The other was to reduce governments. Again, not only was this company surplus rich but it was really a cash cow. Under any given reasonable scenario, they had cash inflows in future years. Given that, 9% Treasuries just seemed like too much. They really just dragged down the portfolio, and they did not need that much liquidity, given the situation that they were in.

There are many financial results that you should look at. The efficient frontier provides a nice summary to give you an overall picture of the results, but you don't want to use it alone. You want to look underneath and look under specific scenarios and see how the company performs. You want to look at distributions like Jay talked about and look at the distribution of returns throughout the stochastic scenarios. This gives you a nice summary, but it certainly doesn't give you the complete picture. The way the efficient frontier works, you want to achieve a higher return with a lower level of risk. You run your strategies through all your scenarios. In this case, I used 1,000 scenarios, and then I have a technique for crunching them to find 100 representative scenarios. There were two strategies. One was the current investment method that they had been using. In the new method, we divested the agencies and reduced the governments and just invest more in the other classes that they had been investing it. Chart 9 shows the two points that come out from these two different sets of strategies.

I run it through the 100 scenarios. You find out what the average or expected return is over the 100 scenarios. You find out what the risk is over the 100 scenarios as well, and graph the two points. You're looking for points that go up to the far left corner. They have a higher expected return with a lower level of risk.

CHART 9
Divest Agencies, Reduce Governments



For return you can use a lot of different measures. You can use ROI or ROE or present value of distributable earnings or GAAP earnings. For risk, the simplest measure is just to use a standard deviation or volatility. I've looked more on a downside risk than the upside risk. That's something you've seen in the literature, as well. As a matter of fact, I think Jay and his people have done some work along those lines. You're not really concerned if the return is higher than the average. It's certainly not what you're worried about. It'd be nice to see, but you're not really looking at the upside risk or the upside standard deviation as being a problem. What you're really concerned with is the downside. What's my worst case? How far below the mean can my returns be and with what probability? So a downside standard deviation can be a better measure of risk than just a regular standard deviation.

From there I start to do tests. Ideally you run all kinds of different strategies, all kinds of different asset mixes and liability crediting strategies, and you end up with a big graph with dots all over it. You find the one that's in the farthest upper left corner, and that's the strategy you should follow. Obviously, practicality makes that very difficult to do.

Let's keep investing the way we invest, but let's look at going longer duration or shorter duration on the bonds (Chart 10). In this case you can see how the curve works. It points to a duration mismatch of about two or so as being somewhat optimal. We can get higher returns when we get more of a mismatch at about two. From there forward, if we go to higher mismatches, we get more risk without much more return. This shows me that a mismatch of about two might be about optimal for this company. Again, you want to look underneath the analysis. You want to look at percentile distributions. You want to look at specific scenarios. You want to look at patterns of earnings. A present value of earnings figure is all well and good the higher it is, but if it's coming at the expense of very volatile earnings patterns over time, that's not something that's very desirable for our industry.

In Chart 11 we look at a different dimension of risk; it's essentially the convexity risk. In this case, a distribution of about 30% mortgage-backed securities and 70% bonds is ideal when looking at the fixed component of the portfolio. To move away from this point in the direction of more bonds didn't really provide enough return. To add more mortgage-backeds provided a lot more risk. You can analyze other investments as well. At this particular company, derivatives were taboo. They just could not invest in derivatives. However, you could start laying derivatives into this process as well as change the risk/reward profile. You can look at different types of derivative and hedging strategies, as well as rebalancing the asset portfolio which is what we're looking at here.

Next, you would look at liability strategies (Chart 12). This company started with a portfolio-based strategy. The chart shows the extremes. It shows completely switching to a new money approach where you always credit new money. Obviously you can get into a lot of trouble doing that. There's going to be scenarios where, if you follow the new money, you really get crushed, and you can see that here. You get a tremendous amount of risk and actually a much lower expected return. Going all the way to new money is not an ideal approach.

CHART 10
Bond Duration

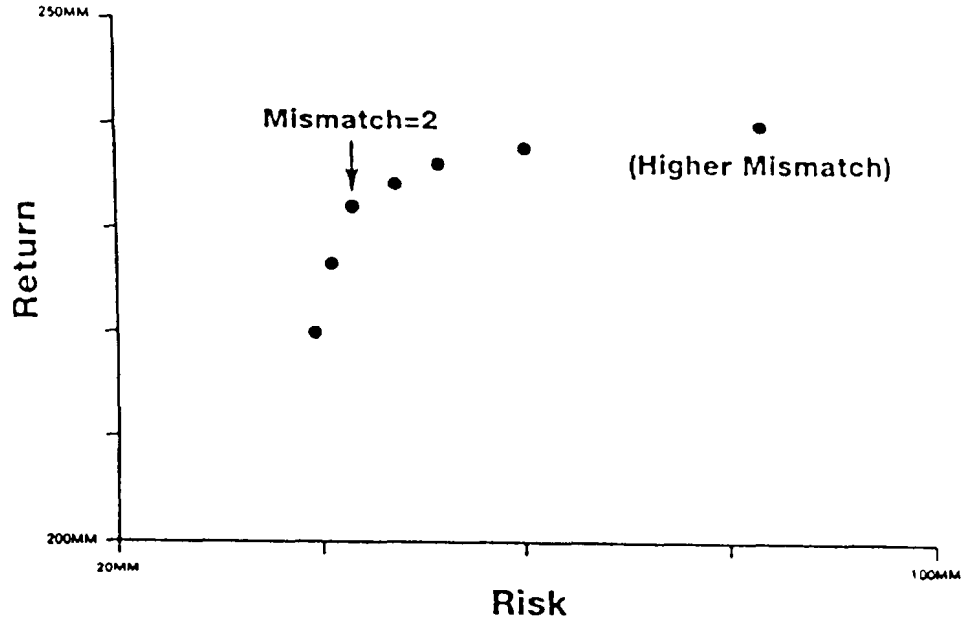


CHART 11
MBS Allocation

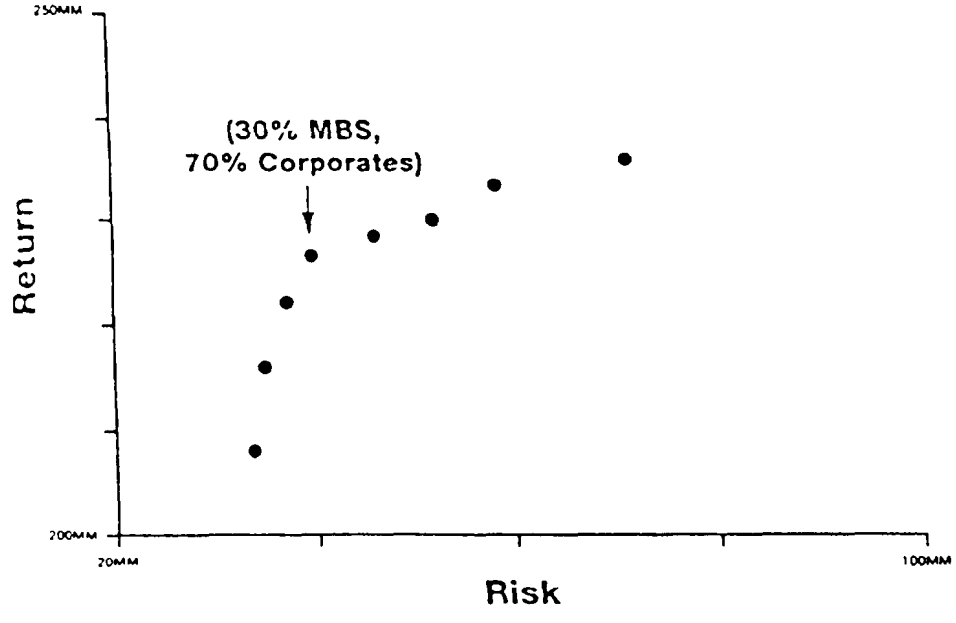
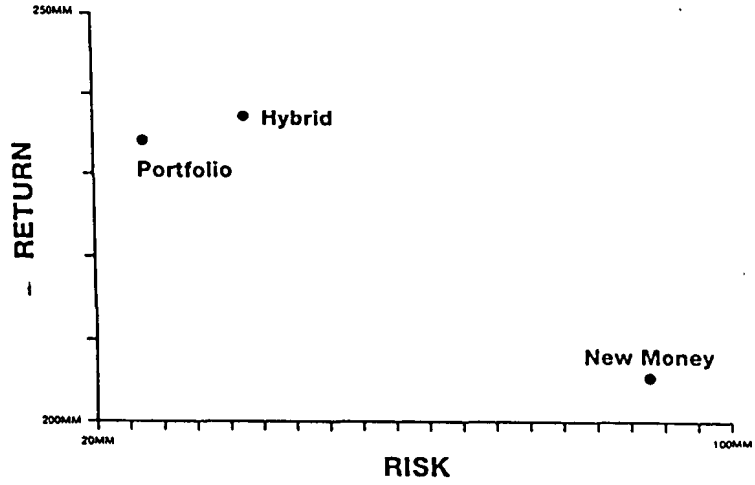


CHART 12
Liability Strategies



The other point I graphed was a hybrid approach where you use the portfolio strategy, the portfolio less a spread—but put a collar on it so that when the new money rate breaks through the collar one way or the other, you start moving more towards the new money rate. In other words, under a pop-up scenario we try to credit the portfolio less a spread, but realize we probably won't get away with that. We'll probably have to start crediting a higher rate in order to keep the field force happy in order to retain the business. We need to move somewhat towards the new money rate. You want to always scrutinize your results. When I look at this picture I could argue that the portfolio rate is still better than the hybrid rate, but the portfolio rate just isn't realistic. Under rising interest rate scenarios, we'll be forced to break away from the portfolio rate so that, in a sense, we're fooling ourselves a little bit to believe that we'll have to stay with the portfolio rate under all economic conditions.

In the end, there is a whole list of recommendations for this company. They include dumping the callable agencies, reducing the Treasuries to 3%, increasing the mortgage-backed securities to 30% and taking additional risk. Another is to increase the duration on the bond portfolio. Start looking at other things like asset-backeds for short-term investments where you can get a little bit extra yield. I also recommend privates. Take a little bit of liquidity risk. The company was always in publics, and they just didn't need to be, especially given their cash situation and their surplus situation.

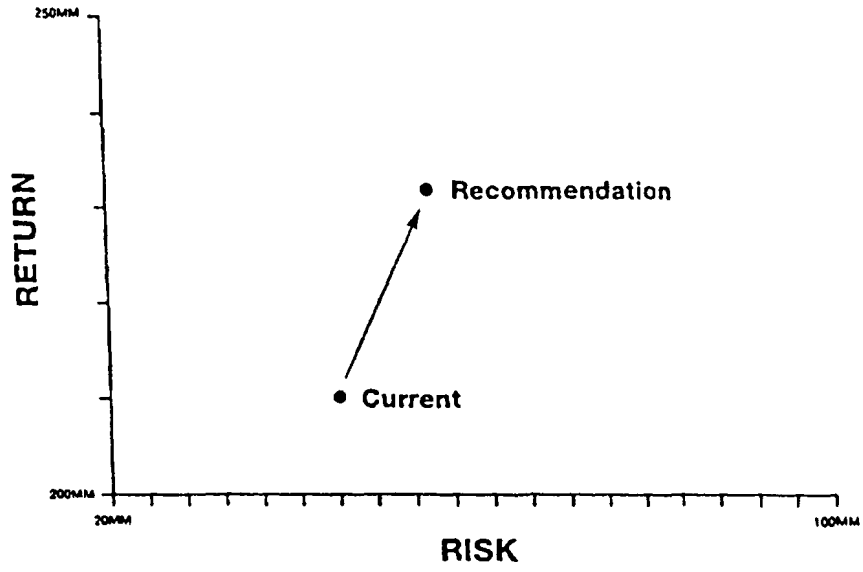
Another recommendation is to split out the surplus account and manage this separately. Stop investing excess surplus in fixed-income instruments, which will drag down your ROEs when surplus is so large. If you have that much surplus, you really have got to go out and find investments that are going to pay more. You either need to be acquiring blocks of business or you need to be investing in, as I've recommended here, equity-type investments, special ventures, and seed money. Or you should pay it out as a dividend and just say, "We're not going to use this money. Let's just get rid of it." To sit on that kind of money and just invest in regular fixed-income is just not an ideal strategy for a company that wants to keep increasing its value and producing a higher ROE.

On the liability side, split more to a new money/old money portfolio rate or rate crediting basis. Recognize the fact that new money should be credited at a different rate than the old money. When rates rise you'll be able to keep up with rising rates by having a new money rate. Also, move to a hybrid new money portfolio approach. Realize that you can't always stick to the portfolio approach under all economic conditions.

If we graph all those recommendations together, we ended up with Chart 13. The results in numerical terms were that we would increase the expected yield over 25 basis points on the reserves. We had a moderate increase in risk. There is an increase in return or expected return, but there's also an increase in risk for the company by doing so. The surplus account shows even larger increases in expected return and definitely larger increases in the risks that we're taking. Thus, we want to split that out and manage it separately.

On a preventative basis, we were able to increase the company value by over $20 million for this particular company. This company is a great example because they really needed some help. Other companies with which I've worked on this don't show such dramatic results, but I've always found this analysis to be beneficial. I've usually found that we could increase expected yield. By doing so, we could take on some, but not much more risk. I had worked with one other company where they were taking on too much risk, and we were able to decrease that risk with only a slight decrease

CHART 13
Recommendations



in return. For most of the portfolios I've look at, it has been a question of being able to increase the yield and either rebalance the risk or take on a little bit more so that we can get that yield and be comfortable with it.

I'd like to briefly mention transfer pricing. We are supposed to be here on new frontiers. I think there are two new frontiers in our industry. One is value-at-risk. Jay briefly mentioned it. There was also another session on value-at-risk. The other frontier is transfer pricing. It's a benchmarking technique where you can evaluate your manager's performance on both sides of the balance sheet. You can look at your asset managers and your liability managers and evaluate their performance separately through the benchmarks. You're able to quantify the risks that you're taking for both sides. It allows you to help put the risk management function where it belongs—in the corporate area. By quantifying the risks and identifying them, you can take the management of those risks out of the portfolio manager's hands and put them into the corporate area where I think they belong.

Many of us are in a situation where our portfolio managers are making bets, and we have an idea of what kind of risks they're taking, but we're not sure. Some of those decisions really shouldn't be the portfolio manager's decision. They really should be the corporate actuary's decision, who has a better understanding of the risks on both sides of the balance sheet. One of the things it allows you to do is invest at the corporate level. It allows you to get these holistic effects that Jay was talking about and omit those line-of-business redundant activities. You can benefit from the synergies of investing at a corporate level through the technique. I mention it because this is, again, supposed to be a session on new frontier. Nancy Bennett is going to present this at another session. Nancy is corporate actuary for Minnesota Mutual, and we've been working with her to help implement this.

Let me give you a cynical view of these new techniques, as much as I strongly believe in them. We've all heard of the life cycle of a product. Chart 14 shows the life cycle of an ALM technique. What tends to happen is our techniques get introduced. We tend to hype them up and think they're going to solve all our problems, and then we start using them. Once we start using them quite a bit, we realize these things have shortcomings, too. Finally, we get to the end where we just bash them to death and go to the newest technique that comes along. Let me give you a quick example.

CHART 14
Life Cycle of an ALM Technique

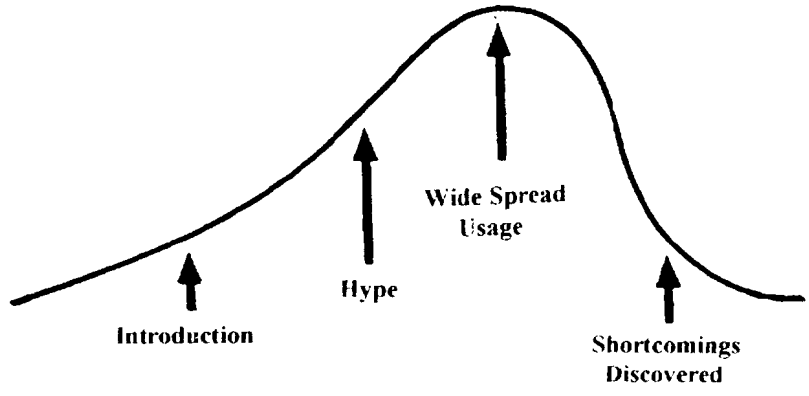


CHART 15
Life Cycle of an ALM Technique

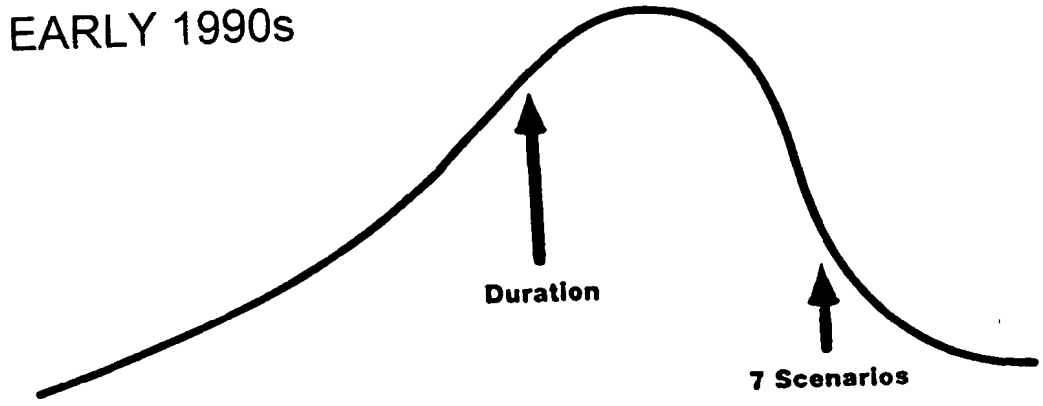
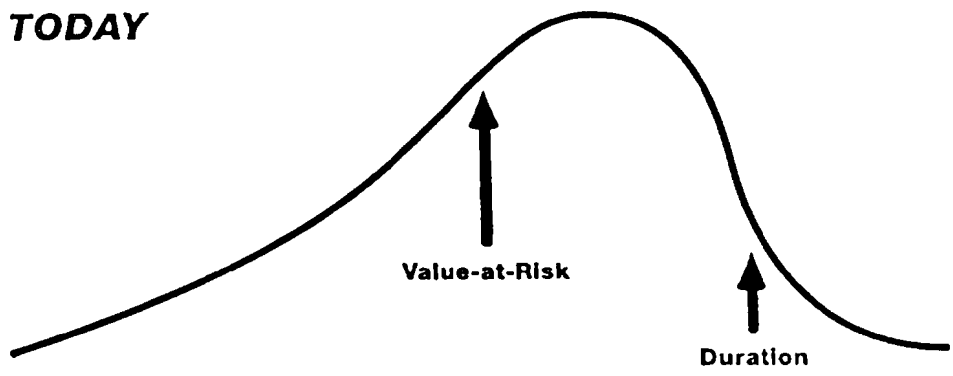


Chart 15 shows where we were in the early 1990s. We just started cash-flow testing, and we realized seven scenarios wasn't enough. Duration came along and we thought that was the way to go.

I think Chart 16 shows where we are today. We reached the point where we started using duration quite a bit, and we've realized that it has shortcomings. Now we're looking for new techniques, value-at-risk being one of them, that can come along and help save us. My point is not to bash the techniques at all because I do believe in them. I think value-at-risk is very powerful. Transfer pricing is as well. I do believe you should scrutinize these things. When you're implementing and talking to the people that are promoting them, you really want to try to find the flaws ahead of time, before you go too far down the road and realize that there are some things that are tough to deal with. You want to scrutinize the new techniques that are coming along. Part of this might be accomplished by finding some help and finding techniques to use.

How should you use a consultant? You should not use a consultant to give you a black box. When I've looked at black boxes, I've just found that they give me problems. Whenever I've gotten underneath them they have biases. All our models have biases. All our models have flaws. None of them are perfect. If you have a black box, these things tend to be hidden. When I've looked underneath I've just found that black boxes provide misleading results.

CHART 16
Life Cycle of an ALM Technique



I also don't believe outsourcing should be the answer. I think ALM is too important to just say, "I'm going to hire a consultant and let him do it." If you're at a small company, the situation might be different. If you're outsourcing a lot of your actuarial work and other things, that's different. But I don't think outsourcing is the way to go for most of us. I think the way to use consultants is to get education and training and to learn from their experience. Get them to give you a better understanding of your risks, and transfer the technology to help you get a process up and running in-house. I think you should be managing your own asset/liability risk; do not have somebody else do it. It really becomes a matter of understanding the risks on both sides of your balance sheet.

What is the biggest risk that we face? My answer is, I don't know. My answer is, the biggest risk is the risk of the unforeseen. Ten years ago, no one ever heard of 1,000% PSA prepayment rates. It was an unforeseen risk. We could have had the best models in the world before that with all our assets and liabilities modeled, but I don't think anybody was putting a 1,000% PSA as an assumption into their model. We didn't know. After that we ran into real estate and commercial mortgages. How many people anticipated the problems that we'd see in the early 1990s?

Now we have a new term in our actuarial vocabulary: market conduct. To me this is a risk that we didn't see. Now it's widespread and it's costing us dearly. Six or eight years ago, who heard of it? The biggest risks are the risks we don't know about. The way to deal with this is not to put a whole lot of faith in betting on one particular risk.

In the life insurance industry, we are highly competitive. We can afford to take risk. We have to take risk because we have to keep up with our competitors who are also doing so. What it boils down to is the lesson of modern portfolio theory, and that's to diversify. You really want to achieve a proper balance, because no matter how good our models are, no matter what our systems tell us, no matter what they say to do, you don't want to overextend yourself in any one risk category because of the fear of the unknown. Something might happen that we just didn't see, and if you're way out there on that particular risk, you can get really hurt. We've often heard about this in our own personal investing. How much do we preach to the personal investors to diversify? I look at a lot of company portfolios, and they're not well-diversified. Many are invested where their particular investment managers have expertise, and they might be taking an overall reasonable level of risk, but it's not well-balanced. Some people are overextended convexity-wise; others are overextended duration-wise, quality-wise, or liquidity-wise. Many people make big bets on a couple of different risks. The real goal is to achieve a balance between them all.