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Tools to Help Senior Management "Manage" Risk

Track: Investment

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Summary: This teaching session discusses the available tools for communicating company risk postures to senior management. The focus is on tools that show distributions of results rather than a point estimate, along with stress testing. Examples include value-at-risk, GAAP earnings-at-risk, option-adjusted value of distributable earnings, price behavior curves, and cash flow at risk.

Mr. Max J. Rudolph: Ken Mungan will be our first presenter. Ken is currently an asset and liability management (ALM) consultant with the Chicago office of Milliman & Robertson. He specializes in ALM, strategic planning, and mergers and acquisitions (M&A). He has extensive experience developing investment strategies for a wide range of insurance company products and modeling insurance company customer behavior.

Ken is an authority on international ALM. He is an FSA and a member of the AAA. Ken received a Bachelor of Science degree from the Massachusetts Institute of Technology.

I focus on financial risk management at Mutual of Omaha. I am an FSA and have completed my CFA designation.

Frank Sabatini, our final speaker, is a partner with Ernst & Young. He is the lead in its risk management and value optimization practice.

Mr. Kenneth Mungan: What Max and Frank are going to talk about is more in terms of the technical tools that are needed to help senior management manage risk. I'm going to talk more in terms of an introductory nature, getting into the softer side of the risk management equation.

The most important tool for helping senior management manage risk is communication. I'm a little biased, but I think that communication with actuaries ranks at the top of the list of communication priorities in the risk management area.

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My own background is, as Max said, in ALM. I do a lot of international work. I'm seeing a tremendous number of changes that highlight the need for improved and more sophisticated risk management at a wide range of companies.

James Benson, this meeting's keynote speaker, discussed some of the changes we're seeing in the insurance arena. He highlighted the actuarial franchise as being mortality, morbidity, and longevity. But also we're seeing actuaries dealing a lot with asset accumulation risks and, in particular, variable guarantees.

I think all of this is coming together. We'll talk about it a later in terms of the future where all these things are going to be linked together; where you will see a need for products with variable guarantees that also deal with traditional risks of mortality and longevity. In all of this, communication with senior management is going to be the key to making these products work and to making insurance companies healthy and vital in the future.

I'm going to go through some of the contents of what I'm going to be talking about. In starting out an active risk management program, actuaries are going to need to make a very vigorous case as to why this program is necessary and what it's going to accomplish. I'll give an example from when Stephen Ross, a professor at MIT, talks to financial institutions about this kind of program.

I'll talk about how risk management can be a tool for competitive advantage. Of course, that will be on top of the list for any senior management group. Finally, I will discuss preserving franchise value. As an M&A consultant I see that in a number of situations.

Once the case has been made for risk management, there are tremendous implementation challenges. They include finding the techniques that fit your organization and your needs, and what the real goals of this type of program are.

Let's consider an example. This comes from a talk that Professor Ross gave at the NYU Stern School of Business annual risk management conference. (There are a number of non-insurance industry conferences out there that are tremendously valuable. They can allow actuaries to reach beyond the actuarial profession to broaden their knowledge of risk management.) In this talk, Professor Ross talked about the fact that you really need to make a detailed analysis of past financial disasters. That can provide key insights for the future. What I found incredibly valuable was that he is one of the most quantitative and technical financial experts in the world; yet he can make a compelling, non-technical, argument for the need to focus on risk management to senior management groups. That's why I think it's worthwhile for people to understand this kind of argument.

In forensic finance, where you're analyzing past disasters, you can see that you really don't need to write a screen full of equations to convince people of the need for risk management. Professor Ross makes six or seven basic points that really do apply directly to the insurance industry.

First and foremost is that prices and yields can and do move an enormous amount in short periods of time. You don't need a fancy model to realize this. You just need to understand that everyone is going to have to deal with this kind of situation at one or more points during their careers.

It could be interest rate spikes or changes in credit spreads as we've seen over the past few years. It could be violent swings in equity prices. As actuaries, we must be able to deal with these kinds of scenarios and situations. We must have strategies in place. I think it goes a lot further than the cash flow testing that we've done in the past.

Second is that, in building an enterprise level view of financial services institutions, senior management needs to develop a shared vision of the future. It sounds like a pretty simple thing to do, but often that needs to be the primary focus of the senior management group in terms of getting everyone moving in the same direction.

Risk management can be seen as something that detracts from that. Because risk managers are often pushing senior managers to examine alternate scenarios, to come up with contingent strategies, this can be seen as a distraction. One has to understand that, without engaging actively in this kind of distracting activity, you could very well never get to your ultimate goal.

Although senior managers are focused on aligning everyone's interest and going towards whatever their vision for the future is, it is important to examine these alternate strategies. In doing that, my point is that statistical approaches to scenario analyses really are lacking. As actuaries we embrace these statistical approaches because they are completely aligned with our training and the types of people that are attracted to be actuaries. But really, one must use greater creativity in constructing scenarios.

The best example I've ever seen of this was when a financial person was asked to look for a hedge fund to help construct a risk management program. One hedge fund was looking at tick-by-tick data of Russian bond prices. They were using that data over a six-month period to build a value-at-risk (VAR) model similar to VAR models that many of you have probably worked with.

In terms of creativity, this person said, "I don't need this model to understand the kinds of scenarios we're going to face. I only need one scenario." That's based on the fact that since 1820 no long-term Russian

bond has ever paid off. Let's start from that basis and build our risk control around that issue.

Often as actuaries we're blinded by all of the statistics and mathematics. We really need to step back and understand that the conclusions we're developing are going to be driving the actions that have enormous financial implications and use some creativity as we do our work.

Compensation must be used to align managers' interest with risk control. You see this in every industry, not just the financial services industry. In insurance companies, often you'll see compensation systems that are described by nice PowerPoint slides that have targets for return on equity, return on target capital, and so on.

From a risk-management point of view, the next step is to bring volatility into that equation. If you look over some reasonable historical time period the people are compensated not just on meeting targets, but also managing volatility and results from one time period to the next.

The next point came from an analysis of the long-term capital management (LTCM) situation in 1998. We see this in the insurance industry over the past couple of years as well. Complex business models are at an extremely high risk of financial disaster. When we decompose the risk that we were exposed to into things like mortality and interest rates and credit spreads, as things get more and more complex, there is a component of model risk there that's extremely difficult to quantify.

If you feel that you're a competently trained financial professional, and if the strategy is so complicated that only the best of the best experts in the organization can understand it, that's probably a warning sign that you may be getting into trouble. You won't realize it until it's much too late.

Liquidity disappears exactly when it's needed. I don't think I need to say any more about this for people who are familiar with what's happening, particularly problems driven by the institutional pension business in the past year.

Finally, business plans are based on specific theories of the financial market. One needs to be able to examine the consequences of these theories being incorrect. This gets back to senior management trying to drive everyone in the same direction and align everyone's interests and priorities. It takes a lot to be able to step back and say, "Well, wait a minute. What happens if this doesn't turn out to be right? Will we be able to survive such a situation?"

The point is 1) it's interesting stuff and 2) you don't need to have an incredibly technical argument to convince people that risk management should be a priority. Risk management is really a tool for creating competitive advantage, just as much as it is a tool for preventing exposure

to undue risk. Risk and profitability are only two parts of the three that you need to have a complete picture.

If, in your modeling and analysis, you're not taking into account the need for growth, then you're really leaving some vital components out. Growth must be part of the equation, and we can talk a little bit about appropriate ways to integrate growth into actuarial models.

I want to share with you some examples where you can use risk management, not as a tool for acting in a police function of keeping people from overstepping their boundaries, but more as a tool for competitive advantage. This would include things like yield enhancement strategies for fixed products, where people are doing asset allocation modeling and then balancing sales considerations with alternative investment strategies and seeing how the whole picture comes together. Derivative strategies that enable companies to be a little bit less risk averse because they know they'll have some protection in down scenarios are another example.

We're also seeing a lot of really sophisticated hedging programs for variable product guarantees. The insurance industry has jumped into offering guarantees on variable products. It is able to do so in a much more cost-efficient way than, say, a Wall Street firm, because it has such a long-term framework for dealing with these guarantees.

Insurance companies, needing to manage this risk, can look at things like reinsurance, static and dynamic hedging, and also the potential for offloading this risk directly into the capital markets by trying to securitize it. I'm seeing some efforts in that area. You can also use internal hedging to maximize growth. That's an area where risk managers can communicate with senior management and really highlight the benefits received. We often divide our companies into all different kinds of buckets, perhaps by product or function, and then analyze the risk at that level. If you don't take the next step of aggregating it all up to the top point, then you're really missing the final, crucial, step that shows how risk can be reduced by taking an ever-wider view. Frank will present some excellent material on that.

The key point that I want to drive home over and over again is that risk management is not equivalent to risk aversion. In creating a culture of risk management over time, if you can get everyone focused on the idea that risk management can not only prevent the bad things from happening, but also open up new opportunities for the company. It can create a much more interested and active audience for this kind of material in your companies.

We talked about making non-technical arguments and then using risk management in the growth equation. The last point I want to make in terms of establishing a solid argument for making risk management one of your core competencies is that risk management, and this really is traditional value, can preserve the franchise value of the enterprise.

Jim Benson highlighted the consolidation trends that we're seeing in the insurance industry. He said 1,500 insurance companies are really not needed in the U.S. He thought we could get down to 1,000, made a prediction for 500, and said that maybe we could get by with 200 insurance companies.

During that period of consolidation there are going to be all kinds of transactions that take place. A key to those transactions is going to be franchise value. Active risk management during this time of consolidation is going to be really crucial.

For those of you not familiar with M&As, you can think of the total company value as being decomposed into three pieces. First, you have the adjusted book value, which is all the profits you've made in the past. All of your capital and surplus is included here, and any reserves you're holding that are in the nature of surplus. Second, the tangible value is all of the profits you're going to make in the future on the business which is already on your books. Finally, the franchise value is future profits associated with future business. These are very likely to accrue to your organization because you've been around for a long time, you have an established distribution channel, and you're not simply going to curl up and disappear overnight.

With adjusted book value and tangible value, there really isn't a lot of argument as to what those values should be, assuming you do a detailed actuarial analysis and get people who have done this over and over again. While complicated in a detailed sense, there's not going to be too much disagreement in the long-term.

But franchise value is another matter. There assumptions have a much greater impact, because you're talking about future sales growth and distribution channel potential. It's a much fuzzier and softer number where risk management can really come into play. The key point is that a crisis situation can simply destroy franchise value, just evaporate it in front of your eyes. During your crisis situation, people become much more conservative and concerned about the future and don't see a lot of optimism.

I do a lot of international work, especially in Japan. The Japanese economy is in a state of crisis, and so you get to see this firsthand quite a bit with the Japanese companies.

I feel obligated to do a numerical example. Actuaries, myself included, don't feel anything is complete unless it's boiled down to some numbers. Table 1 is a hypothetical example of a company valuation. There are three components of value: adjusted book value, tangible value, and franchise value. For the normal economic environment we have some hypothetical values, and then in the crisis situation.

TABLE 1

	Normal Economic Environment	Crisis Situation	Percentage Decline
Adjusted Book Value	10	7	30%
Tangible Value	30	21	30%
Franchise Value	60	21	65%
Total Value	100	49	51%

The point is that, in a crisis situation, sure, the adjusted book value and tangible value probably deteriorated by the very nature of the crisis. But, in terms of a franchise value, where that's much more based on people's views of the future and people's sense of the health of an organization, it's going to be even more greatly affected. I arbitrarily put 65% here after talking to a number of M&A actuaries. To be honest, that's probably a conservative number in terms of the impact on the franchise value. An active risk-management program can reduce the potential for a crisis and preserve franchise value.

Armed with these tools everybody's ready to go in and talk with their senior management groups and, hopefully, either establish or reinforce the need for a risk management program. That's where the really difficult part starts. We face some very difficult challenges in implementation.

One implementation challenge is going to be effective communication, because you're dealing with extremely technical and difficult material with people who aren't necessarily experts in this field. You will also be challenged to come up with effective financial performance measures that can drive action. Max and Frank will talk about that in greater detail.

It is difficult to have up-to-date technology, especially considering some of the strategies that companies are taking to manage features such as variable product guarantees. I guarantee you that none of the financial production systems that were around even five years ago ever thought that risk management strategies would be so complex. There's a constant need to stay up to date.

Realistic customer behavior remodeling is important. If you have optimistic assumptions as to how your customers are going to behave, then you can go through a very detailed risk management analysis and exercise and produce numbers that simply don't mean very much. This is a continuous improvement process: the willingness to fail, in some sense. Engage in this activity and recognize that whatever results you produce will probably need to be improved time and time again.

As I've stressed, it's important to create a risk-management culture where there's a critical level of understanding of risk management analysis and the need for risk management. If a crisis situation develops, often you'll see a

cultural discontinuity within an organization. ALM people, risk managers, or analytical people familiar with analytical models are trained in their use. In a crisis situation the people that are going to have a great say in how the crisis will be handled are trained in the legal framework and a boardroom framework, resulting in a non-actuarial sense of the issues.

It's important to work together with these groups from the start. If you let a crisis situation develop or if one comes about and then you're communicating for the first time, your analysis will simply not make it through that barrier.

Finally, risk management is often perceived as leading to risk aversion. If you have a committee structure where you talk about the lowest common denominator of risk tolerance, where the person in the group who's most risk-averse can bring the committee down to that level, there really is a failure in creating a risk management culture. By culture, I mean sticking to a target level of risk that the organization is comfortable with and recognizing that that's not going to be a comfortable level for every person involved in the decision-making process.

Some of the risk management techniques include option-adjusted value of distributed earnings (OAVDE), VAR that some companies are working on, transfer pricing, and scenario analysis. It would take me all day to go through all of these techniques.

The overall goal of using them is to establish a set of tools you feel is right for your company and to raise the awareness in terms of the understanding and use of these tools above a critical level. By a critical level I mean a level at which you can drive action, where it's not just an interesting study but can actually lead to taking some action within your organization.

These tools produce results that are understood by senior management. To be understood, these tools have to quantify values of interest to senior management. Often, as actuaries, we think very long term. When I produce appraisal values, I'm thinking in terms of present values of 20- and 30-year projections, whereas senior management is often focused on 1- or 2-year projections of GAAP earnings. Any complete risk-management system has to deal with both, and deal both in terms of expected values and volatility of results.

Some of the actions that can be driven by risk management programs are things like alternative product design. We talked about variable product guarantees. That's a new product design that has come in over the past few years. Other examples include changes in distribution strategy, asset allocation, or reinsurance.

Let me just wrap up by asking, how many people in the audience feel that you've got a risk-management program in place where you are actively producing analysis that you think does at least a decent job of quantifying

the risk that you face? Quite a few. Now of those people, how many feel it's actually being used to the level where it is driving action in your company. About half of the original group. It seems like companies have come a long way, and there's still some potential to move even further.

Mr. Rudolph: As I listened to Ken's presentation, I thought about a common thread between our three presentations beyond the title of the session. The common thread is that these tools can give your company a competitive advantage either over your competitors or maybe the correct decision is to not write a policy for a specific client. Maybe it's allowing you to expand your decision set and make you a stronger competitor. As Ken said, it's only an advantage if we can communicate the results to others. I would focus on that as well.

What I'm going to talk about is leveraging off of models that you already have. At my company, Mutual of Omaha, we already have models that are designed to create economic surplus, with option-adjusted duration a byproduct of that process.

What we're trying to do is say, "How can we continue to leverage those models which started out as cash-flow testing models, and then became value-added models, and then became duration models? How can we leverage off of that to use the same model for every analysis that we do?"

What I'm trying to do, and a lot of other people from other companies and consulting firms are working on the same thing, is to move closer to an optimization using risk return profiles. Moving beyond duration management to actually use these tools to be driving an actionable event in terms of what you want to do. Duration management has the potential to lead to risk aversion. As an insurance company, if we don't take any risks, then what value are we adding? It's a matter of choosing which risks we want to take and which we're best capable of taking.

Rating agencies and insurance departments focus on duration and similar tools, so I'm not saying we shouldn't be using these tools. By using the same models to do statutory projections, cash-flow testing, GAAP projections and cash-flow projections, you get an economy of scale. You don't have two or three different models that you always have to true up to each other.

At our company, I have a GAAP projection that's shows quarterly results and I want to use the same model for a 30-year value-added projection. Management might ask, "Well, how does that compare back to this next quarter? What's going to happen?" If I have used the same model, I can say it's the same. It eliminates a lot of the discussion that doesn't really add value. Now the offset to that is, these models take longer to run.

With duration management, our goal is for assets and liabilities (A/L) to move in tandem. We're really immunizing the surplus ratio. If you immunize the dollars of surplus you can get some pretty bizarre results.

Duration management ignores a number of things, among them rebalancing costs.

The example I'll go through is one where the liability duration can change from 12 to 2 very quickly. If you say, "I'm going to have to throw out all of those assets and start over," there's a cost of rebalancing as well. With duration, the return implications are minimized in new business. You assume that new business is matched. At least as far as we've put it together so far it is not included. That's another place where someone may have already leapfrogged what we do.

By looking at the enterprise duration, aggregating it from the product line level up to the total, it becomes a really useful tool. Not only are you looking at how your durations vary by product line relative to your plan, but also you're able to look at your total company.

David Babbel, a professor at Wharton, used to run an ALM seminar for the Society. The last time it did that was in 1996. That's where I was introduced to a lot of these enterprise duration concepts. He used an example of a live company that asked him to look at their block of business. He told them that they had a duration of 40. They no idea that they were taking this huge risk, that if interest rates went up by 2.5% they would be technically insolvent. It's important to know what your risk is.

At the Investment Section sponsored seminar in Tucson in June 2000, we talked a lot in our breakout sessions about the resources that this type of analysis takes. It does take some resources, but it is very important. I think you get a bang for your buck by doing it.

I want to define a couple of terms. What is economic surplus? It's the difference between the option-adjusted value of your asset and liability cash flows. It's generally going to be greater than your statutory or GAAP surplus. It will be more volatile than your statutory surplus, because you're looking at immediate changes due to interest rate shifts. As soon as interest rates go up 10 basis points you're recognizing that and perhaps driving an actionable event.

If you have actionable events every 10 basis points, maybe this isn't the best tool to use, and maybe you're overusing the tool. But at some point you do want it to be an actionable event. Economic surplus looks at both sides of the balance sheet, where *FAS 115* only looks at the asset side. I view this as the intrinsic value of the firm's in force business. Not everyone agrees with me on this topic.

It's the Mr. Market story that Benjamin Graham used to tell. Mr. Market will knock on your door every day and say, "Here's how much I'm willing to give you for that stock," or "Here's how much you have to give me for that stock." You then make the decision whether you want to buy that stock or whether you want to sell the stock you already have.

I view economic surplus as the same thing for a company. If you calculate it, then you have a baseline in a potential merger. You have an idea of how much your firm is worth. Then if somebody comes and says, "I'm willing to pay a number that's two times that," you'll maybe listen to them a lot closer than if they come to you with a number that's half what you think it is worth. It's another tool to use.

One of the things we've been working on a lot, and other companies are too, is trying to move beyond the SPDA example. For years presenters have stood up here and said, "Well, here's my SPDA example." Theoretically it should move beyond that and be useable for universal life or long-term care or group life, i.e., for every line of business that you have.

I think the models are now getting to the point where we can do that. Our analysis of A/Ls is driven by cash flows. We talk about cash inflow versus cash outflow. What that means is that premium flows are combined with the asset cash flows. If you net your premiums against liabilities, you can get an infinite duration for your liabilities in a place where it doesn't make any sense to have that. If you bring all your incoming cash flows together and all your outgoing cash flows out together, I think it's a much more flexible structure.

You already know, I'm sure, that this process is option pricing, modeling your embedded options, allowing your cash flows to vary with interest rates, and then running against stochastically generated interest rate scenarios. If you can utilize some variance reduction techniques to reduce the number of scenarios, those techniques can add value by freeing up run time to use for analysis.

Chart 1 is a price behavior curve for a block of universal life policies. If rates go down, assets will prepay and interest rate guarantees kick in. The liabilities are convex as interest rates go down. In this example, due to make-whole provisions in our bonds, there's not a lot of convexity in the assets. As rates go up your assets lengthen and your policyholders are going to leave.

The next step beyond this project is to model stochastically other variables besides interest rates. I'm giving a prelude to Frank's presentation, but several of the actuarial software systems now allow you to model stochastic mortality, morbidity, and asset defaults, pretty much anything you think can be modeled.

This project was driven by the phenomenon shown in Chart 2. Across a wide variety of potential scenarios starting from year-end 1998 it shows that if interest rates had gone down 200 basis points, the duration would have been upwards of ten.

There was a duration of five at year-end 1998 and that had been stable for a number of years, so we decided not to do partial durations. Curves always

go up and down in parallel, don't they? They never invert. I think there's going to be a lot more work on partial or key rate durations this year as people are saying, "Well, how does that impact us?"

In fact, since year-end 1998 rates have gone up about 200 basis points. Since we made this Chart they've actually come back a little bit. But the point is still worth making. For universal life blocks, the duration changes quickly based on movements in interest rates.

My untested hypothesis is that this is driven by the interaction between the cost of insurance (COI) charges and the OAV and how your net amount at risk grows or shrinks based on how much interest you're able to credit, along with the impact of future expected premiums.

As an industry, I think there is subsidization going on between the sources of earnings from mortality and interest. I don't think we look at each of those separately. I think we look at a combined result of a specific spread and COI rates. I think maybe that's driving some of this volatility.

Other projects that leverage off of these models include optimizing your crediting and investment strategies. Given limited resources, obviously you have to prioritize.

Let me go through a couple of definitions, because we've defined things one way and maybe your company has defined them a little bit differently. We've defined required assets. Required assets are not tied to any accounting system. Whether reporting statutory or GAAP it shouldn't change how many dollars of assets you need to fulfill your liabilities.

In our case we've chosen to drive that off of statutory reserves plus X times risk-based capital (RBC). I've seen a couple of studies where it seems like people are using anywhere from 150-250% of RBC. That seems to cover most companies, with more companies right in the middle at 200-225%. GAAP required assets are defined in exactly the same way, so your GAAP target surplus is backed into based on this formula.

Distributable earnings are defined such that, for each period, you hold the required assets and release the excess. This is driving off of Dave Becker's work on OAVDE.

Let's move on to risk return profiles. What we're trying to do is take these same models that showed a highly volatile duration over a range of interest rates scenarios, and to ask, "Okay, what tools should we use to measure the risk return tradeoffs?"

The tool that we chose was present value of distributable earnings, and for the first pass we've ignored the rebalancing costs. We take our asset portfolio that currently has a duration of 5, and replace it with a portfolio with duration of 0.6 of a year.

We also want to show these results graphically. If management says, "That's really nice. Come back in six months and show us something else and we'll tell the rating agencies we're doing something, then we haven't done our job." We really want to make this something that drives business decisions and defines actionable events.

We're doing an OAVDE analysis and measuring the option-adjusted spread (OAS) across that. That's the spread over Treasuries that equates present value of the flows with our initial investment. Our initial investment is the GAAP target surplus.

We call it a two-step process, but really we're doing the same thing from two perspectives. We look at the OAS that makes the OAVDE equal the initial investment and then we compare the OAS across each investment strategy. We also pick a spread appropriate to the risk and use it to discount profits across all scenarios. The results were consistent.

We started off with our current investment strategy of duration five. Comparing yields of assets with a duration 5 as opposed to a duration 0.6, the spread is about 100 basis points higher for the longer duration portfolio, at least at the time when we did these scenarios. We built synthetic assets that would reproduce a duration and convexity similar to the actual assets in the portfolio to facilitate running a lot of scenarios.

As expected when we compared the two investment strategies, we found that the existing investment strategy was more risky as measured by volatility of present value of distributable earnings (PVDE) results. You get an extra 113 basis points of OAS, which makes sense. If you take more risk you should benefit from that.

If I go up to my CEO and say, "The option-adjusted spread is 113 basis points higher, so we should do this." I'm not going to spend much time ever again visiting with my CEO. What we're trying to do is come back to some graphical representation of the results that gets our desired message across.

I know Frank has done similar work to this. In Chart 3 we're taking the current investment strategy, where the duration of the assets are longer than the duration of the liabilities, running our scenarios through and graphing the PVDE. Then we sort them from low to high.

Not too surprisingly, when rates go down results are good. Our guarantees are low enough that they don't come into play in these scenarios. When rates go up, people leave, and that's bad.

We compared that, in Chart 4, against a matched investment strategy where both A/Ls are about 0.6. Not too surprisingly, the risk is reduced. You essentially have reinsured, or hedged, your interest rate risk.

You have immunized the risk against increasing scenarios, but you've paid something for that, just like you do with reinsurance. You have a lower expected value. We did look at this scenario by scenario. It's not like one scenario does real well in one and real bad in another. It's pretty much across the board, so I feel pretty comfortable with the results we're getting.

Our conclusion is that it doesn't make sense to invest as short as the liabilities would indicate, which is what we wanted to say when we started this project. We're very pleased, because it told us that what we thought made sense. That doesn't always happen.

To include the rebalancing cost, you subtract it from each scenario. When you compare Chart 5 against Chart 3 where no asset portfolio changes are made, it confirms that you shouldn't do anything.

I think that regulators and rating agencies like the duration tool. They like to ask duration questions. But I think if you can show them that, even though by one measure you're taking more risk, the results of that additional risk show that you're coming out ahead in every scenario except one, they will listen to you.

If you're coming out ahead in most scenarios, then maybe you apply a hedge to take care of those scenarios where you don't. It leads to other questions that would, again, be actionable.

In summary, duration and option pricing tools are not something I'm recommending you throw away. They are useful for establishing investment constraints, monitoring changes in your economic surplus, and for fulfilling rating agency and other requests. But remember that there are limitations. It's not always going to give you the best risk return comparison. You might not be on the efficient frontier if you're doing that.

It's important for us to remember that when universal life (UL) products were initially sold, mainly in the early 1980s, risk management tools were not available. I look at that completely differently than I do a UL product that is being sold today. We need to be doing stochastic analysis, whether it is interest rates, mortality or morbidity on the health products. We need to be looking at what the distribution of results is.

Mr. Francis P. Sabatini: Our world is changing. As financial professionals, we need to change with it. In order to do that, we need to provide management with information that helps them balance their needs for reward and increasing the value of the organization, while playing that against the risk that they take.

My definition of risk management or value optimization is the process of providing management with information that allows them to, 1) avoid making the wrong decision; 2) make decisions that they wouldn't otherwise

make; 3) make good, sound, business decisions, and 4) ultimately increase shareholder value.

There is a tremendous impetus for change. Change in the way we manage our business, change in the way we, as financial engineers, help our management transform their business.

Technology is getting better, and that means we need to make maximum use of that technology. How many people have network gigabyte machines hanging together to do their work? I do.

Ken mentioned that if you look back in history, the things we have spent years doing, the duration calculations and the ALM studies, are not the things that cause a lot of the distress that we have seen. There are a lot of other things that are factoring into the erosion of value in those companies.

This is the reason why the industry is moving toward an enterprise risk model. If you look at history, concentration risk is probably the single most important factor leading to insurance company financial difficulties. That's a risk that we haven't really done a good job of measuring. As our business gets more complex the operational risks, things like market conduct and litigation, are the ones we do not normally model or measure. I refer to them as non-financial risks.

Chart 6 shows a model to implement a full enterprise-wide risk management (ERM) process. The key is identifying the risk. At the end of the day you're going to have to quantify it. What's the probability we're going to get a lawsuit on this product, given the way we market it? It's an interesting question. It can be done.

I want to talk about using tools to develop management information as it relates to financial risks. It's a different way to look at it, a different way to get management's attention, with ideas to help management increase value.

Financial risk management is holistic. Those of you who know me know that I don't believe in ad hoc risk analysis of value optimization. The aggregate is the most important thing. You look at it from the organization as a whole.

How often do you hear management say, "Do we have the right risk balance? Are we taking too much interest rate risk or credit risk or too much of another kind of risk versus any other kind of risk?" Do you hear that? They might think it more than they say it. Wouldn't it be nice if you knew how much of each kind of risk you had in terms of relative proportion? That's what this is going to try to do. Each risk element is typically defined by statistical techniques reflecting historical experience or expectations for the future, recognizing the correlations between the various risks.

Let's look at a case study. We're going to look at a company with \$1.8 billion of liabilities. Universal life has \$500 million, variable annuities \$800

million, and it just so happens they're in the banking business and they have \$500 million of 5-year CDs.

The UL product line is a typical UL product. Its crediting strategy is portfolio rate minus spread. The variable annuities have a reasonably rich death benefit.

We're going to back the UL block with corporate bonds and mortgage pass-throughs. Not something I would recommend, but we're going to back the bank CDs with mortgage pass-throughs as well.

We have five risk elements here: interest rate, credit, lapse, equity markets, and mortality. I don't think there is anything missing. We're going to use the earnings-at-risk (EAR) metric. We're going to look at three different time horizons: 1-year, 5-year, and 10-year. Chart 7 illustrates EAR. In this case we're talking about statutory book profits. We could talk about GAAP profits instead. We ran a stochastic simulation and used a five-year horizon for the example.

For every scenario, you add together the book profits over five years. Instead of discounting or accumulating them, you add them together. If you wanted to, you could discount or accumulate the results. I like adding them, because I can get the CEO in the room and he or she can look at the expected value and divide by five, and say, "Yeah, that's \$10 million in earnings a year. That's about right." You can't do that when you discount it. It gets confusing.

We got the sum of five years of book profits for each scenario across about a thousand scenarios. We rank-ordered them from highest to lowest. That's all we did to create the profile. The amount of earnings-at-risk in this case is the mean value minus some point in the distribution. This could be the 10th percentile, which says you have a 10% chance of losing that much in earnings.

Let's talk about the stochastics. Obviously, interest rates are stochastic. You need to use a good interest rate generator, understand it, and make sure it's going to give you a robust scenario set.

On the variable annuity side, in the modeling that we do, we distinguish between different types of subaccounts. We don't model every subaccount in the variable annuity, but you can look at Morningstar, VARDS, or your own methodology. You can map every fund into a particular asset class: large cap, small cap, international equity bond fund, and so forth.

Our stochastic generation methodology allows us to project returns at the fund account level. That process is used in our variable annuity example.

There are a number of ways to address credit risk. What we did was look at historical credit loss experience and fit curves at each credit rating, so AAA

has a curve, mean and variance, AA has a curve, mean and variance, and so forth.

If you look at the curves, the interesting thing is that you get a distribution that's similar with experience. Material credit events occur infrequently, and the rest of the time you have an expected level of nominal activity.

We've treated credit events as if they are an independent variable. Credit correlations have been examined by us, and a lot of other academics and we can't figure out what credit events are correlated with. But if you think you know what they're correlated with you can do it that way as well.

For mortality we got a little fancy. We factored in both systematic and non-systematic risk into the mortality element. In one case we're just saying, "Hey, period to period I have an expected q_x , but I have a variance around that q_x ."

Did you ever sit in a meeting and say, "Gee whiz, we got this spike in mortality, we can't figure out why."? Often it is just statistical variation.

Then you have long-term trends in mortality that are driven by medical advances and other things. The way we built the distributions that are going to drive the stochastics around mortality, there is an inherent long-term trend in mortality.

Finally, we took lapses and treated them separately as one element. There are different ways to do this. We took base and dynamic lapse and we're going to put it in with the interest rate dynamics. But then within that we're going to look at statistical variation of lapses around this expected value. There are other ways to do this. There's no best way.

Okay, it just so happens I ended up with an UL example. There was no collusion with Max. We're using a stochastic process. Interest rates are stochastic. Lapses are stochastic. Credit is stochastic. Mortality is stochastic.

The total column of Table 2 is looking at the results of running everything on a stochastic basis. One way to look at it is, if you run 300 interest scenarios and 300 credit scenarios, you have 300 times 300. That's not exactly the way we did it, but you can think of it in those terms. You could have different credit events along different paths.

TABLE 2
FRM Case Study - UL Results (5 year)

Percentile	Total	Lapse	Credit	Mortality	Interest
1st	(\$12.1)	\$20.8	\$13.8	\$9.5	(\$0.5)
5th	1.6	21.1	16.3	13.9	5.5
25th	9.0	21.4	18.0	18.6	12.9
50th	14.0	21.6	18.9	21.6	18.8
75th	18.6	21.8	19.8	23.4	22.5
100th	29.9	22.5	21.4	34.0	28.5
Mean	\$12.1	\$21.6	\$18.4	\$21.7	\$16.1
EAR	10.5	0.5	2.1	7.8	10.6

The mean value in this example on the \$500 million UL block, with the 5-year book profits added together, is \$12.1 million, which is \$2.4 million a year.

The earnings at risk are \$10.5 million, which are 12.1 minus 1.6 at the fifth percentile. You have a 5% chance you could lose \$10.5 million, and if you divide that 10.5 by 12.1, that's a fairly large percentage.

Looking at the distribution, it's interesting to note that in the first percentile, you could actually lose a couple million dollars a year in that scenario. You might want to strip that out, analyze it, and subject it to some further scenario analysis.

Let's look at the interest column. There are different ways to do this. They all have pluses and minuses. There's no perfect way. For the column labeled interest, interest rates were stochastic and everything else was not. Similar activities occur for each of the other elements. For the mortality risk you define a single interest rate path, keep credit and lapses constant, and vary the mortality. You can see the at-risk amount, giving you an idea of how much relative risk you have.

The other thing to note is that the sum of the pieces is much bigger than the whole. This is because all of these risk elements are not perfectly correlated. Some of them are correlated to some degree such as the debt and equity markets and others are totally uncorrelated.

The equity market is not 100% correlated with interest rates and, of course, depending on what time horizon you look over, that correlation could be -0.6 to -0.4.

We defined credit as uncorrelated. Mortality is clearly independent of the others. It would be interesting to do some sort of study to see if credit events and mortality are correlated.

The fact that they're not correlated would suggest that the sum of the individual pieces, which adds up to 21, is not going to equal the result when everything is stochastic.

Your credit event isn't necessarily going to happen at the same time that interest rates knock you in the socks. You end up with a reduction due to the correlation effect and total risk exposure of \$10.5 million. You start to get a sense of the relative contribution of risk.

What I've illustrated is the contribution of risk on the uncorrelated total, and there are different ways to produce the risk contribution to the correlated total. Some of them are mathematically intense if you can think back to some of your statistical work. But even taking a proportion method will get you pretty close. Fifty percent of your exposure is interest rate, 10% credit, 2% lapses, and 38% mortality.

What would management say if you told them they were taking five times as much interest rate risk as they were credit risk over the next five-year period? Or that they had that much mortality risk, assuming some long-term trends in mortality.

We went ahead and did the same thing across the other two products, variable annuities and the bank CD. You end up with a risk contribution matrix. Let's look at the products first.

As you can see in Table 3, the largest risk contribution for variable annuities is equity market exposure. Surprise, surprise. Remember these are riskless products. What's going on here?

TABLE 3
FRM Case Study

Risk Element Contribution	UL	VA	CD	UnCor.	Cor. Effect	Holistic
Interest Rate	\$10.6	\$1.3	\$6.1	\$18.0	(\$1.9)	\$16.1
Equity		13.1		13.1		13.1
Credit	2.1			2.1		2.1
Lapse	0.5	0.6	0.1	1.2	(0.3)	0.9
Mortality	7.8	0.2		8.0		8.0
Uncorrelated Total	21.0	15.2	6.2	42.4	(2.2)	40.2
Correlation Effect	(10.5)	(2.6)	(0.1)	(13.2)		(22.9)
Correlated Total	10.5	12.6	6.1	29.2		17.3

A little bit of it is guaranteed minimum death benefit. But pure market volatility is most of it. The market goes down 20%, revenue goes down 20%. How many people truly believe that expenses are going to go down 20% at the same time? (No one raises their hands). By viewing the combination of guarantees and equity exposure, you can split apart the 13.1 as to how much is guarantees and how much each piece.

Variable annuities show a little bit of interest rate risk. Why? Debt and equity markets are correlated, and there are bond funds. We've modeled lapses by measuring statistical variation about the base rates in a dynamic lapse expected value. You wouldn't expect to get much risk contribution from those, and you don't.

Of course, the mortality is relatively small on the variable annuity piece, and actually that's more the guarantees and the way we modeled these guarantees. They started out of the money, which helped a lot. One of the keys in terms of getting that exposure is what your expectation of future fund performance will be. The CD contributes risk, not surprisingly, almost completely from interest rate risk. We also modeled a little bit of lapse risk.

The uncorrelated interest rate risks add up to 18. But when you run it all together, your interest rate risk is only 16.1. Why is there a difference? Well, for UL you have a two-sided risk. When interest rates go down, you run up against minimum guarantees. When interest rates go up, lapses are higher and that hurts you.

You've got two risk events for variable annuities, the rise of interest rates and the decline in account value against the fixed expense base. For CDs there's a high interest rate mismatch risk. It's not happening all at the same time and all in the same scenario. When you look at it in a holistic context, you get a slightly lower result due to the correlation effect. Clearly, there's nothing that correlates with the equity exposure. Credit risk is embedded in the UL products, so it carries all the way over. Lapse and then mortality is embedded. You end up with a distribution of risk across product and across risk element. It ends up about 40% interest rate risk, 33% equity, 5% credit, 2% lapses, and 20% mortality. Now you can start having a conversation with management about how much risk you have in a relative context.

The other thing to note is the exposure on a fully correlated basis is only 17.3, which is about \$3.5 million a year. It is not \$3.5 million a year of purely interest rate risk. It starts to change your perspective in terms of how much. Again, look at that little credit number. If you believe the way we modeled the mortality, that's not insignificant. Again, these have all been earnings-at-risk results.

It's important to look at the distribution of results. Often I display this graphically. The expected value is 34.7 across all the products. Divide by 5, and that's nearly 7 per year. The 25th percentile is 29.7, the median 36.9 and the 75th percentile 44.3.

For earnings-at-risk you would typically want to look at the mean versus the fifth percentile. There are different ways of looking at this. It depends on what you're concerned about. One point to note is that the 0th percentile is a pretty small number.

Now we're going to look at the same products with the same process over 1-, 5-, and 10-year periods. We've talked about the distribution of the five-year time horizon results. Let's look at one year. Table 4 shows the results. It's interesting to note, if you look at the uncorrelated total, it's roughly \$8 million a year, and about \$9.5 million average for 10 years in terms of risk exposure. The same thing is true on the correlated total, it's about \$3.5-4 million a year.

TABLE 4
FRM Case Study

Risk Element	EAR¹	EAR⁵	EAR¹⁰
Interest Rate	\$1.6	\$16.1	\$38.7
Equity	3.6	13.1	31.0
Credit	1.1	2.1	2.4
Lapse	0.0	0.9	5.7
Mortality	<u>1.5</u>	<u>8.1</u>	<u>17.6</u>
Uncorrelated Total	7.8	40.2	95.4
Correlation Effect	(4.0)	(22.9)	(58.8)
Correlated Total	3.8	17.3	36.6

The per-annum earnings-at-risk exposure using this metric is the same over time. That's interesting. But what's even more interesting is that all of a sudden now, over a one-year time horizon, credit goes from about 5% in the 5-year situation to 14% of the total risk.

Equity risk is now your biggest exposure over one year accounting for 46%. Interest rate and mortality risk exposures are about 20%. That makes sense.

Credit events, if they're going to happen, they're going to happen big, and they're going to have a one-year impact. This is getting at the probability of having a credit event, assuming credit events are random. If you look at it over 10 years, credit risk is relatively small. It reflects the fact that, given the history of credit events, you can time diversify credit exposures. What does this tell me as a risk manager?

Maybe I should be thinking about a strategy that protects my short-term downside exposure to credit, but takes a big risk long-term. If I can find a way to do that I should ultimately increase the value of the organization.

Table 4 shows the relative contribution of equity risk. How many people believe that equity risk is as big an exposure as interest rate risk in their company? One. I would argue that you need more hands. If you're writing both fixed and variable products, this kind of analysis is going to start to change that thought process.

I'm going to illustrate another use of this whole methodology and I'm going to take a little editorial license. Let's say today we have the business

previously described (\$500 million of UL and CDs, and \$800 million of variable annuities), and three years from now we want to have UL \$400 million, variable annuities \$1.3 billion, and CDs \$100 million. Doesn't that look like what's happened to some companies? That all of a sudden variable annuities are a much bigger piece of the exposure than they were several years ago?

All we've done is change the mix of business. Somehow we've transformed the company and we're doing this analysis as if it all took place at the same point in time. Some editorial license. Table 5 shows the results from the new mix. What's changed? When we increased our exposure to variable annuities, we certainly increased our exposure to the equity markets. Interest rate exposure is significantly decreased and we've gotten some proportional decreases in the other risk elements.

TABLE 5
FRM Case Study (Mix Variation)

Risk Element Contribution	UL	VA	CD	UnCor.	Cor. Effect	Holistic	Original
Interest Rate	\$8.5	\$2.1	\$1.2	\$11.8	(\$0.4)	\$11.4	\$16.1
Equity		\$21.3		\$21.3		\$21.3	\$13.1
Credit	\$1.7			\$1.7		\$1.7	\$2.1
Lapse	\$0.4	\$1.0		\$1.4	(\$0.2)	\$1.2	\$0.9
Mortality	\$6.2	\$0.3		\$6.6		\$6.7	\$8.0
Uncorrelated Total	\$16.8	\$24.7	\$1.2	\$42.7	(\$0.6)	\$42.3	\$40.2
Correlation Effect	(\$7.1)	(\$4.2)	(\$0.1)	(\$11.3)		(\$24.4)	(\$22.9)
Correlated Total	\$9.7	\$20.5	\$1.3	\$31.4		\$17.9	\$17.3

The uncorrelated risk total is pretty much the same, as well as the correlated total. Conclusion? The overall risk position hasn't really changed all that much. But our relative exposure to a particular element has increased dramatically. How do we feel about that? Do we want to manage our business, and of course you can start getting behind the numbers to really understand what that means in terms of how much we can lose, and how quickly.

Table 6 shows the distribution of results for the two mix assumptions side by side. The old mix has minimum value \$1.1 million, expected value \$34.7 million and risk exposure using earnings at risk of \$17.3 million.

TABLE 6
FRM Case Study (Percentile Distribution)

Percentile	New Mix Value	Original Mix Value
0	(\$20.4)	\$1.1
5 th	7.7	17.1
25 th	20.8	29.7
50 th	28.7	36.9
75 th	37.5	44.3
95 th	46.5	51.8
100 th	58.2	62.1
Mean	25.6	34.7
Mean - 5th	17.9	17.3

With the new mix, not surprisingly, we've lost almost \$10 million in expected value. This represents a shift from higher margin to lower margin products. This shouldn't surprise anybody. Have we added value by using that strategy? We've got more assets with the same risk. Have we increased the company's exposure to risk? We certainly have.

I want to talk a little bit about another thought process in terms of optimizing value. In this context we're going to use distributable earnings, but we're going to try to risk adjust it. There are several ways to use risk adjust. You can risk adjust the earnings or you could use a different discount rate reflects the relative inherent risk in those businesses.

For this I will rely on audience participation. consider two products, equity indexed annuity (EIA) and variable annuity (VA). Equity indexed annuities in our stochastic pricing exercise have an expected return of 13.3%, variable annuities 14.9%. You can only issue one product. How many want VA? How many want EIA? (More voted for EIA.)

Here are a couple more statistics. The standard deviation of internal rate of return (IRR) is 7.8% for the EIA and 12.4% for the variable annuities. Let's calculate an average path IRR, which takes the mean distributable earnings for each year and discounts it. Then solve for your IRR. The IRR would be 15.1% VA, 11.8% EIA. Variable annuities still look like a good deal.

Tenth percentile IRR is 6% EIA and -0.4% for VA. The fifth percentile is 5.3% EIA and -7% VA. Now you start to wonder if VA is the better product, right? Let's go through a process where the hurdle rate is the discount rate used to adjust to the inherent risk in the particular product.

Variable annuities, based on these statistics, suggest more risk: a higher hurdle rate (15.3%) for VA with EIA showing less relative risk and a lower hurdle rate (9.9%). Discounting now at my hurdle rate, where is the value? The EIAs risk-adjusted value is \$53.1 and VA is (\$0.9). This is a new

business example. What business do I want to be in? Equity indexed annuities.

From the Floor: I'd like to ask Frank about his EIA product. Is the product supported by equities options, and is the example contrived or real?

Mr. Sabatini: It's real. And it's options.

From the Floor: It's all options. There are no equities behind it. Otherwise we'd expect the equity risk to be comparable, and so if you had a more standard approach you'd do that. You have all option pricing.

Mr. Sabatini: Yes. We're buying bonds and S&P 500 options.

From the Floor: Presumably you would get an entirely different answer if you had a different investment mix to support the product.

Mr. Sabatini: Correct.

CHART 1
Price Behavior Curve for Block of UL Policies

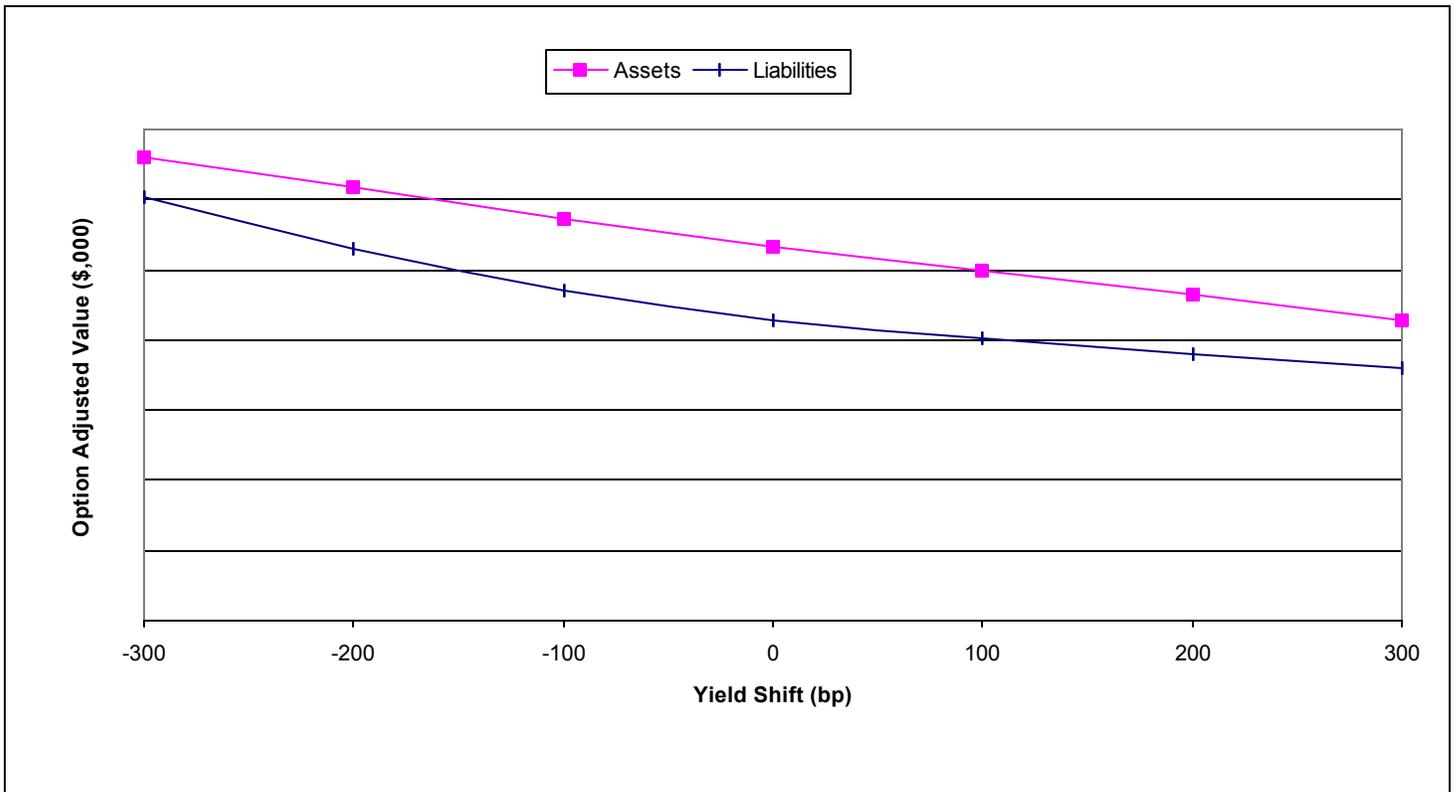


CHART 2
Duration Target Volatility (UL Example)

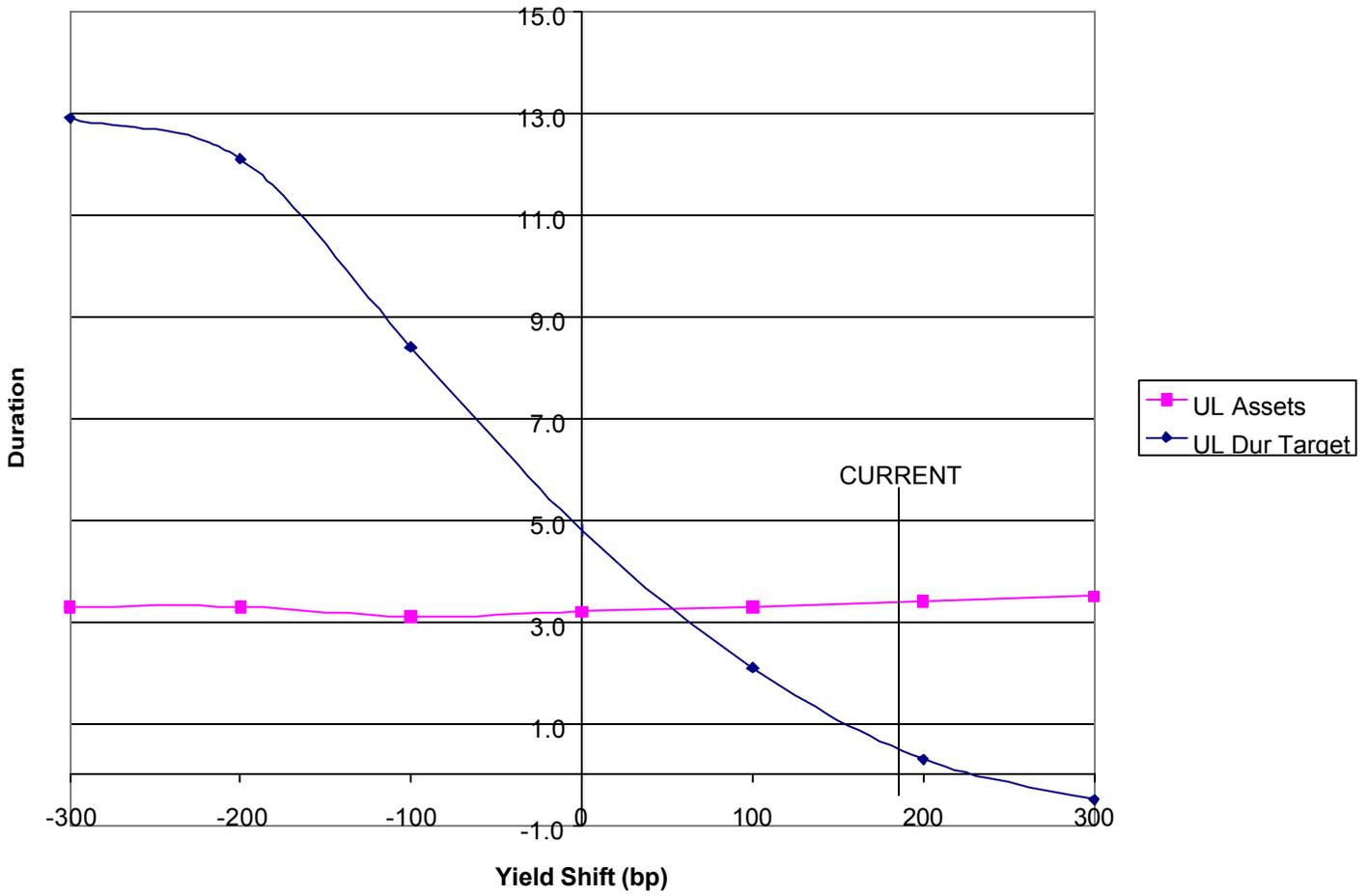


CHART 3
Current Investment Strategy

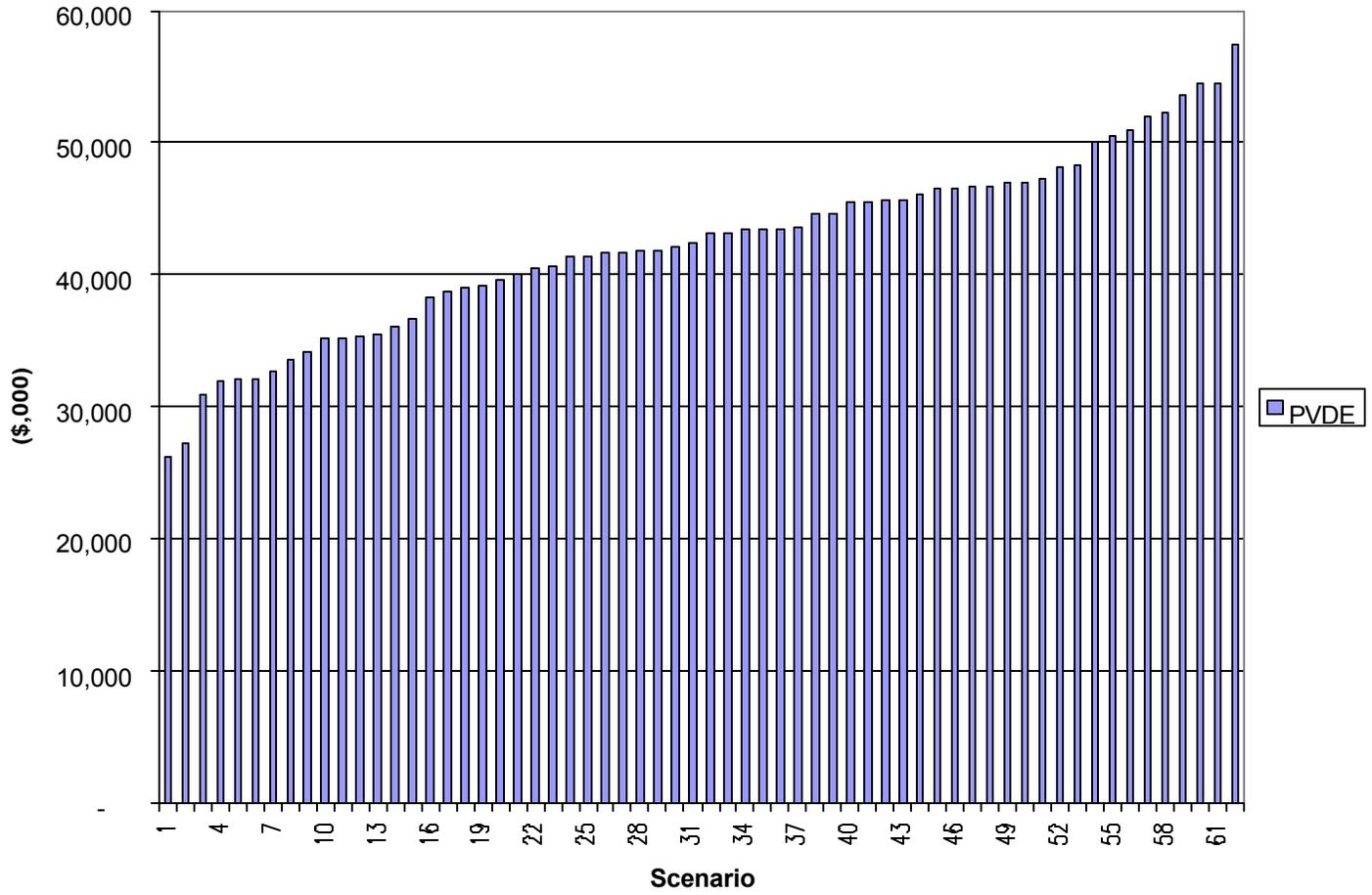


CHART 4
Short Investment Strategy

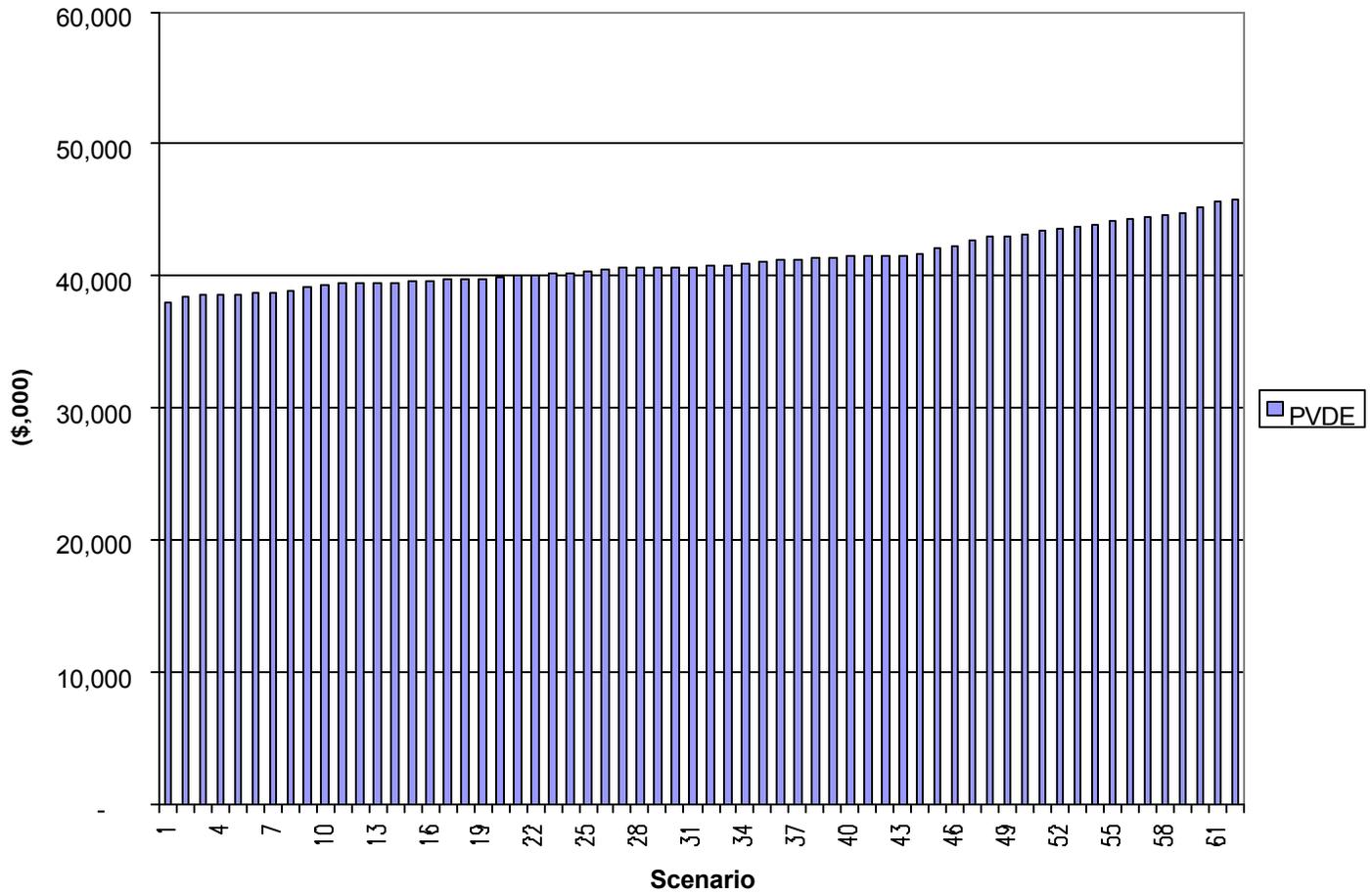


CHART 5
Short Investment Strategy with Rebalancing Costs

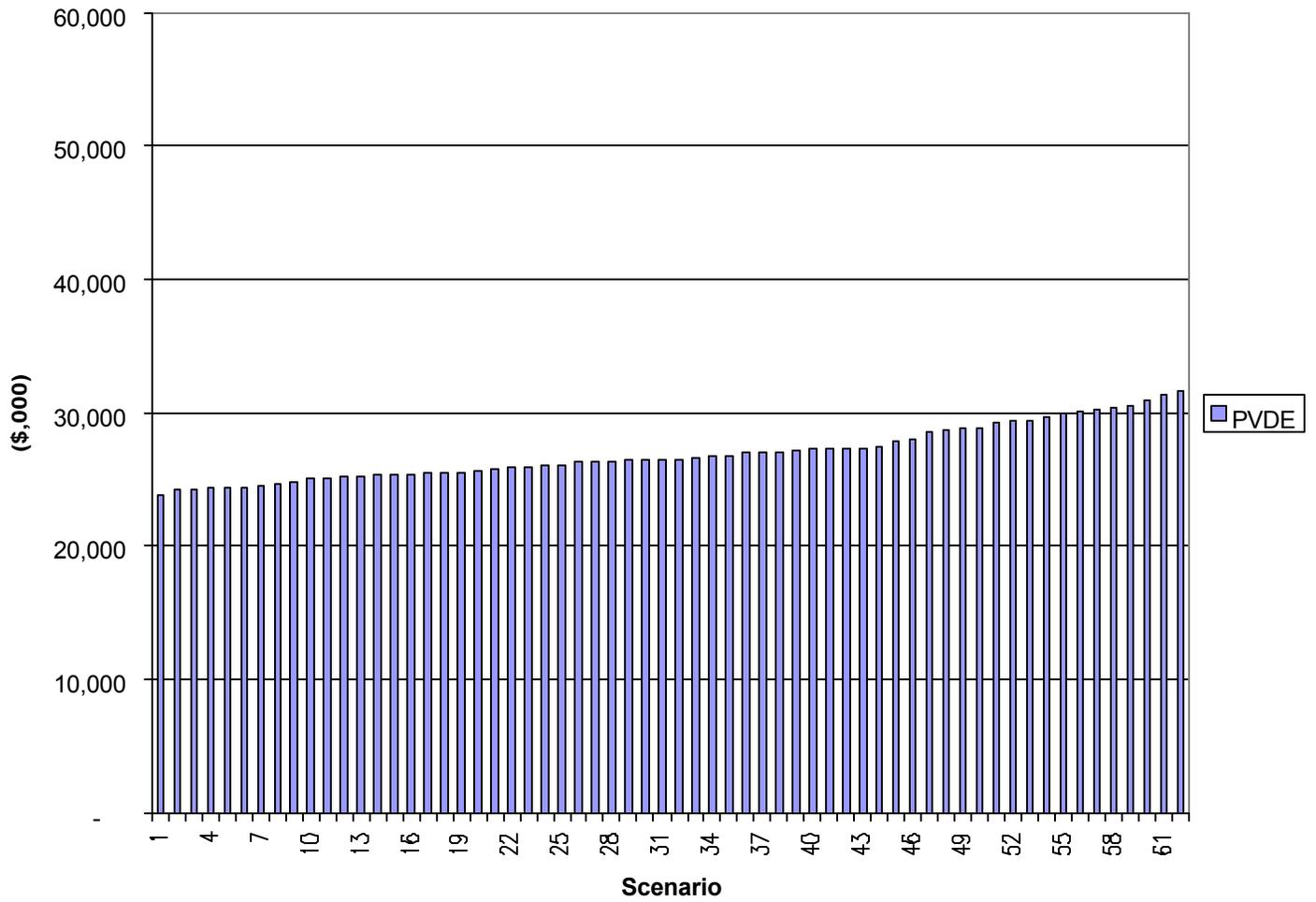


CHART 6

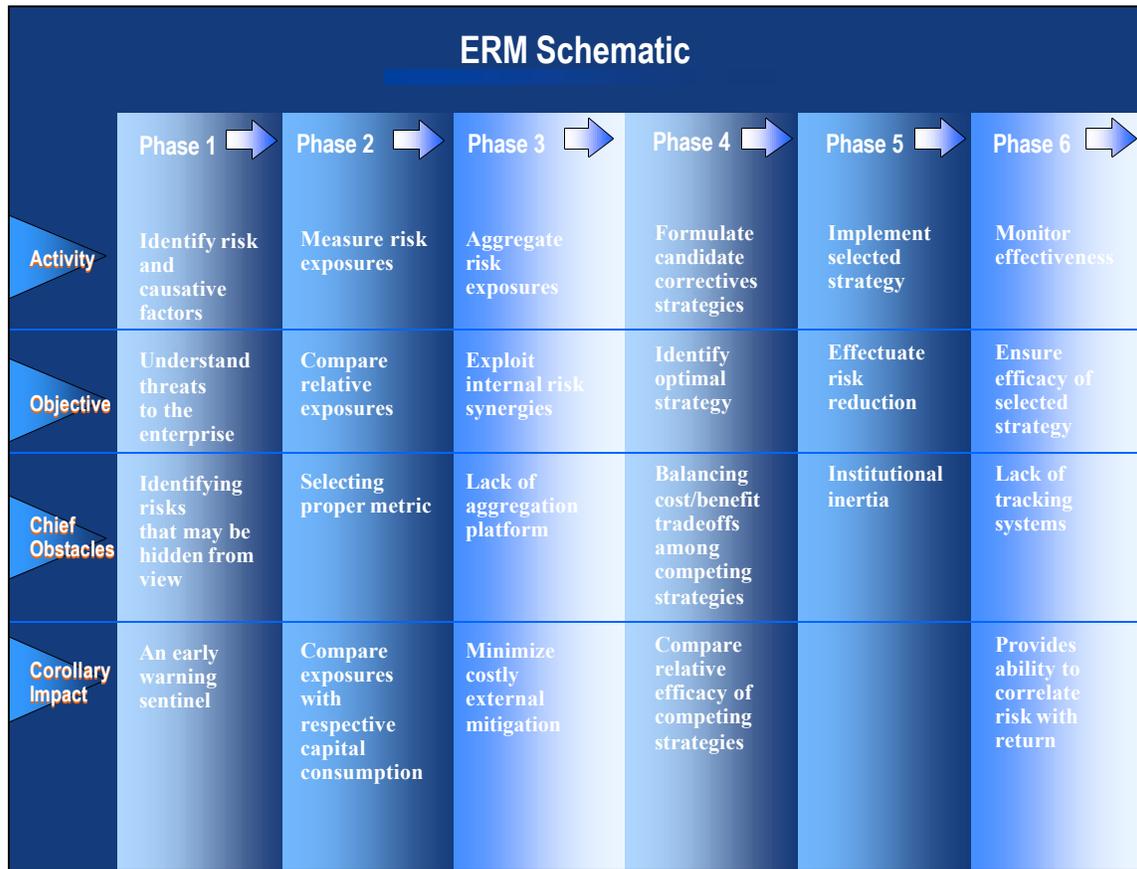


CHART 7

