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ENTERPRISE RISK MANAGEMENT MEETS UNIFIED VALUATION SYSTEM

Track: Investment

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Summary: There appears to be many similarities between enterprise risk management techniques and the theory underlying the unified valuation system (UVS). What are the challenges of each, and can the methods learn from each other?

MR. MAX RUDOLPH: I'm vice president at Mutual of Omaha, focusing on financial risk management. We have a very distinguished panel this morning. I'm very pleased to have Bob Wilcox on the unified valuation system (UVS) topic. Bob is past Insurance Commissioner of Utah and currently heads up R.E. Wilcox and Company. He consults and is very active with the Society of Actuaries, the American Academy of Actuaries, and a number of other places. Bob is going to focus his comments on UVS.

Frank Sabatini, who's a partner with Ernst & Young, runs their risk and value optimization team out of Hartford. Frank is going to talk more about the practical side of enterprise risk management, or holistic risk management.

This session came about because every session I attended on either UVS or enterprise risk management seemed to discuss the same tools. It's the same tool set for either project. They're just used a little differently, and they talk about

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Note: The chart(s) referred to in the text can be found at the end of the manuscript.

things a little bit differently. If we learn these tools, we can leverage our work across a lot of different projects within our own firms.

MR. ROBERT WILCOX: I am going to be talking about UVS, but let me provide some background first. I left the Utah Insurance Commissioner's office at the end of 1996 and had been actively involved with the Life and Health Actuarial Task Force at the National Association of Insurance Commissioners (NAIC). As I went back out into consulting work, the Life and Health Actuarial Task Force at the NAIC asked the Academy to take a look at the overall approach to valuation and do it with a clean piece of paper. They wanted to figure out how you would do valuation if you didn't have the constraints and preconceived ideas that have built up for over a century. The Academy asked me if I would chair that task force. We opened the doors to anyone who wanted to participate.

Over the next year-and-a-half, we developed an approach. At one of our meetings, we were trying to come up with a label to put on this project. Someone said, "Well, we're trying to unify a number of things together, why don't we call it unified valuation system, or UVS for short?" So that name was hung on it. The overall concept that we came up with looks at the overall financial capability of the insurance company to meet its financial obligations. We wanted to spend less time drawing the line between reserves and capital. It evolved into an approach that would best be characterized as based on ruin theory. We were looking at a constraint where the company would have at least X probability of meeting all of its obligations and surviving into the future.

That constraint was for the obligations already on the books of the company, but we also felt that it was very important to look at the company's ability to carry out its business plan. We added a viability analysis that included not only the obligations that were already undertaken by the company, but the obligations and the cost of implementing the company's business plan over some future time period. That was the development of the system that we're going to be talking about today.

I'm trying to put this into a context of the factors that influence this confrontation, if you will, between risk management and the new millennium. I'm going to talk a little bit about the history, some additional approaches to financial modeling, and the next steps for modeling and regulation.

The four elements leading to the current status are (1) the incremental development, (2) the international perspective, (3) the blurring of the financial services boundaries, and (4) the fact that as an industry we're generally undervalued. In terms of the incremental approach, we find these to be at least contributing factors.

First of all, the technological revolution has seen tremendous improvements in what we are capable of doing. I'm just old enough to be able to claim that computers

were invented in my lifetime. I've watched over the years as they increased the capabilities of what they enable us to do. We can now do things that in the past we only dreamed about. One result is that not only are we able to improve our modeling capability, but they have enabled companies to improve their administrative capability. Now we can offer products that we couldn't even administer previously. This has changed the landscape a great deal.

One of the results is that life companies are now concerned about tail events, but you could also think about them as low probability, high impact contingencies. The property and casualty (P&C) industry has always had to deal with these and is very adept at it. Another factor in terms of this development is that banks have increased the extent to which they do internal capital modeling.

Internationally we see tremendous changes. We see multinational non-U.S.-based insurance companies taking a very prominent role in the world insurance market. We need to look at how you should manage a company that operates in many countries. The European Union has set a deadline of 2005 for adopting a new accounting approach that would, presumably, apply to insurance companies as well. We have both the International Accounting Standards Board (IASB) and the International Association of Insurance Supervisors (IAIS) developing objective answers that will have implications for all of us, whether we're in Europe, North America, or anywhere else in the world.

This blurring of financial boundaries is an interesting concept. Of course, the big event that started it was the creation of Citicorp, as Citibank merged with Travelers, but a number of other things are also taking place. The response in the United States has been the creation of the Gramm-Leach-Bliley Act, which gives the Federal Reserve responsibility over banks and bank holding companies involved in insurance and how risk-based capital (RBC) is managed there.

I've had the opportunity to give a couple of presentations to the Federal Reserve to help them understand the risk issues involving insurance. Regarding what the European Union is looking at for 2005, their primary source is the Basel II framework, which is designed for banks. There's a good deal of interest in carrying that over to insurers. The IASB had been looking at a new basis for insurance, which up until now we thought would be a fair value approach as the accountants define it. It looks like it's going to be fair value, but not necessarily as the accountants define it. In any scenario, it's a different approach from what we have been using in the United States.

I mentioned this undervaluing of the industry. There's a statement by Laurence Meyer of the Federal Reserve, in which he says bank stocks tend to trade at lower multiples of earnings than the equities of many other industries. One conventional explanation for this is that banks are quite opaque. That is, current financials are not transparent enough. Financials for insurers are worse.

Here are some other reasons why the insurance industry is likely to be undervalued. The approach that is generally taken to defining current income and solvency standards doesn't optimize rational behavior when you're talking about capital management. We also tend to manage to earnings rather than value added. All this said, the risk games that people play primarily around the regulatory structure will continue.

In terms of the timeline context, it's been interesting. As we've been developing UVS over the last several years, I've talked to lots of actuaries. Lots of them are my age and think this is a wonderful idea. They say, "Just promise me you won't do it for five years because then I'll be retired." When I say maybe in my lifetime, you should interpret that as work lifetime. But it's likely that we're going to see stronger and stronger elements of this coming into play. I gave a presentation on recommendations from the International Actuarial Association (IAA), a white paper written specifically for the IAIS on the role of the actuary in the Prudential Insurance supervision. One of the concepts that was presented there in terms of the ideal role for the actuary in insurance supervision involved almost precisely what we have defined as the unified valuation system. And it didn't come from the United States. This was developed by a group of actuaries from all over the world who were, again, saying, "How would we do this if we were able to do it in the best possible way?"

I need to talk a little bit about approaches to managing this black box called an insurance company. Insurance management tends to do this from a bottom-up approach, and appropriately so. Insurance regulators, traditionally, have looked from the top down. The banking industry has learned to get around that problem in recent years and does both a top-down and bottom-up approach.

Insurance management teams use bottom-up tools like embedded value and risk adjusted return on capital. It's a total company worldview. Basically, that means that as you model the various parts of the company you use worldview scenarios, so that the correlation is automatically built into the model. Conditional tail expectation is another tool as you try to measure those low frequency, high impact events.

Insurance regulators, particularly in the United States, but also in most parts of the world—it used to be true in Canada, too—have taken the top-down approach. Although many regulators are trying to get better risk information, it's generally formula driven, assuming that one size fits all. RBC is only partially risk-based, because it's a formula that draws some generalized conclusions about the company's business. It doesn't really deal with the details of the risk. RBC, as it was developed in the United States (with Utah being one of the first places it was developed), was only intended to provide an action-level trigger. At that point, the regulator could call on the company management to do some additional things or increase the regulator's authority to do some additional things. It doesn't recognize adequately that the risk varies by the kind of underwriting you do, the lapse

experience that you have, tail events, and the many things that a company is able to do to manage and control its risk. The regulator has for many years been primarily required to go through a checklist and make sure that he checks off everything on the list. The company prepares a number of reports that are useful only to the regulator. They don't serve any other purpose.

The banking proposal that's included in Basel II uses a three-pillar approach, with minimum capital requirements, supervisory review, and market discipline via disclosure. The primary thing that it does to the regulators is to change them from a checklist checker to having an ongoing dialogue with the company. This is already occurring in the United States in the bank regulatory system's dealings with banks, where there's an ongoing dialogue between regulators and companies. We have a ways to go in the United States, in particular, to reach a level of trust and understanding where regulation can be dialogued-based, but to be effective it's got to get there.

The UVS concept, as developed by the Academy, says that risk is best managed by using the company's experience and models, not somebody else's idea of what they ought to be. It deals with a minimum probability of ruin. This doesn't deal with the most likely result or even the likely probability of ruin. It deals with how you bring discipline to this process. Discipline comes through public and confidential regulatory disclosure. That indicates at least two levels of disclosure that need to take place. There also needs to be a feedback loop.

Many people are not familiar with Schedule P. This is something that's been in the P&C annual statement blank forever. It allows you to check from year to year to see how your estimates of reserves last year have developed since that time. It contains 10 years of history on loss developments. Remember that P&C reserves are primarily loss reserves. This estimates the claims you're going to pay on claims already incurred. You can look back to 1991 and see how those reserves have changed each year as you revised your estimates as you paid out an additional part of a claim. We need more of those kinds of feedback loops in life and health reserving systems so that we can track our success. As I said before, the regulator role needs to change from a checklist checker to one based on dialogue.

In terms of the UVS project, we've met the NAIC request. We've done what they asked us to do, and for that reason the Valuation Task Force that undertook that project is no longer in existence. There are a number of areas where the current system shows weaknesses. Other committees and task forces are now applying the concepts of UVS. Within the NAIC there's an ongoing effort to explore how nonformulaic approaches to liquidity, risk-based capital, and reserve issues can be applied.

Let's briefly discuss the project's next steps. The ongoing difficulty between life and P&C actuaries in the United States is an unfortunate development. When we began this project, we saw that we were undertaking a number of things that the P&C

actuaries are very good at. We sought their help and didn't get it. Finally, we got some level of involvement and a bit of it was helpful. Most of it was antagonistic. Yet, logic is logic and risk is risk. The dichotomy that exists between life and P&C is at best unfortunate and we need to improve the level of coordination because there's no reason for that sort of thing to exist. We've made some progress in that regard. A great deal more progress needs to be made so that as we're dealing with these projects, it's risk-based and not based on the conventions of what we call things.

By virtue of my past as an insurance regulator, I've dealt with a lot of P&C companies. I find that we do the same things, but we call them by different names. We have to get over that. The fault lies with both groups. It goes in both directions.

When we're dealing with measurement, which you have to do to a certain extent, subjectivity comes into play. There are no open and deep markets with which to calibrate as we have with asset risks. We have to find other ways to deal with it. The low frequency, high impact events are particularly difficult to deal with, which leads us to manipulation. These are challenges that we have in dealing with the UVS or anything like it.

There are some tools for dealing with subjectivity and manipulation. One is to use statistical techniques and professional judgment in order to make this work. We have to apply professional standards, which is going to require the development of professional standards. The Actuarial Standards Board is going to have some challenges to put standards around this in order to create the necessary discipline.

There are some ways that you can use market rates with observable data to define the discount rate. That can be helpful. More disclosure is going to be essential, then a regulatory review. I think in that particular regard we're all trying to catch up with Canada in terms of the regulatory review. By the time we get there they will have improved it, but Canada has set the standard for regulatory review processes like UVS. You can also impose some level of discipline with a minimum capital requirement that provides a floor for all of this.

The IAIS will likely borrow a great deal from the Basel II framework. I'm sure the IAIS is looking at issues specific to this choice. For example, there's no risk credit in the Basel II framework for diversification. Doing the things that we ought to do to manage our risks isn't reflected in it.

Bank risk is exclusively on the assets side of the balance sheet. While insurers have simpler asset problems than banks do to some degree, they have much more complex liabilities and therein lies a lot of the problem in terms of applying the Basel II framework. The risk horizon that banks look at is very, very short. Essentially, they look at assets and the risks associated with those assets as things they can get out of in weeks, if not days. That certainly isn't true for insurance

companies that undertake contractual obligations that can go on not for days, weeks, months, or years, but at least decades and maybe centuries. That certainly changes how we have to deal with these risks. The focus of the Basel II framework is on expected losses and needs to shift to more of a statistical approach. The probabilities, the standard deviations, and the impact of the tail events detail this approach.

Canada has moved to joint supervision of banks and insurers. That seems to be a trend that is affecting much of the world. As I understand it, Canada is actively exploring the use of the Basel II concept for Canadian regulation. They want to apply it not only to banks, but also to insurance companies and insurance companies within bank holding companies. We're going to see a great deal of change there, certainly in terms of the application of dynamic models to the regulatory process. They have implemented something in Canada that needs to be a part of a UVS application. They've come a long way.

Going back to concepts that link life, health, and P&C risk, they all have to deal with the time value of money. They all have to deal with probabilities applied to claim frequency and severity. Credibility theory is the basis for an estimation of what's going to take place in the future. We all need to improve our ability to focus on the forest of the key risks rather than on the trees of the numbers and models. If you just turn on the computer, see what comes out, and are done with it, that is not appropriate risk management.

Some new concepts will be needed in the future. Actuaries need to change their roles. When I started in this business back in the 1960s, the primary aptitude that an actuary had to have—and many of you won't even understand this— was the ability to add columns of large numbers backwards. For those of you who have grown up in an era without computation functions, that won't make any sense at all. But the role of actuaries has changed during my career, and it needs to change a great deal more.

Most insurance companies will have someone designated as a risk manager who isn't an actuary and doesn't deal with any of their contractual risks. Hence, they don't deal with any of the major risks imbedded in insurance. I maintain that there's no one in the company better able to manage, identify, and measure the risks, to put numbers to them, than the actuarial staff of the company. The appointed actuary's role needs to be more than was required in the past. This actuary needs to be a risk manager, identifying the key risks that the company has, figuring out how to manage and mitigate those risks, measuring them, and reporting back to the board of directors on the ability of the company to survive the contingent events to which it's exposed.

There needs to be a more responsible role for actuaries in regulation. In the United States we say regulation, while most of the rest of the world says supervision. In the United States supervision has a different connotation. If the company moves

from regulation to supervision, it's in trouble. But in the governance process actuaries need to take on a more responsible role. Not only in terms of making sure the board of directors is aware of what's going on with risk, but making sure that there's an active dialogue with regulators and, particularly, that regulators are advised when things begin to turn sour.

We need to develop better models for understanding low frequency events. Colorado, for example, is involved in the modeling of hurricanes. Maybe that location was chosen so the basis of information that we have for modeling hurricanes will never be destroyed by a hurricane. We also see models for modeling earthquakes and geological events. While we do have some models for low frequency events that can occur in the financial marketplace, I don't think they're at the same level as we have for predicting hurricanes and earthquakes. We need to improve our understanding of those events and our ability to model them. We need to migrate in our thinking as life valuation actuaries from one number to ranges of numbers and an understanding of that range and what it means.

As much as anything, there needs to be a change in the legal framework for insurer regulation in the United States. It must encourage open dialogue between companies and regulators, while protecting actuaries in the process. Actuaries cannot do the job that they need to do without freedom from the litigation that would otherwise certainly fall to them.

MR. FRANCIS SABATINI: I'm going to approach my talk from a very practical side of this issue. I'm going to focus more on the topic of risk management, but I think there are two overlays here. One is that almost everything I say has application to UVS as much as it does to risk management. We need to keep that in mind, and I'll try and do a good job of keeping that thread in play. I'm also going to present some actual results that can be extendable to implementation of UVS. It will be kind of nice to see a prototype, if you will. But keep in mind that I want you to use your powers of thought to extrapolate and create a vision as to how you can use the tool or the concepts that I'm presenting—not necessarily in terms of managing your business and the role of an actuary today, but in the future as the company risk manager.

Table 1

UVS vs. Risk Management

	<u>Risk Management</u>	<u>UVS</u>
Focus:	Mitigation, Value Creation	Value Preservation - Solvency
Framework:	Assets, Liabilities, Earnings, etc.	Liability only, Valuation
Risks:	All	All
Synergies:	Yes	Yes
Holistic:	Yes	Yes
Stochastic:	Yes	Yes
Assumptions:	Best Estimate	Best Estimate
Results Orientation:	Mean vs. Tail	Tail
Timeframe	Today	Tomorrow

I want to start by contrasting UVS and risk management. I took a list of characteristics and compared UVS and risk management side-by-side. For risk management, you're usually focused on mitigation and risk avoidance. I'm going to try and destroy that notion. You're also focused on value creation. That's a notion I want to build on. UVS is focused on value preservation and solvency. Clearly, there is a difference. The framework for risk management includes assets, liabilities, and earnings. The UVS framework includes assets, liabilities, and valuation.

In an enterprise risk management context, you're worried about all of the risks. Are you worried about synergies and the fact that there are offsetting dynamics? Having two product lines that are negatively correlated should reduce your capital and reserve requirements. Are you concerned about that in a valuation context? Certainly. Do you want that holistic view? It allows you to leverage and take advantage of the synergies. Both work in a stochastic framework. Are you using best estimate assumptions? This is a big change in mindset from a regulatory point of view.

In terms of orientation of the results, there's a slight difference here. In UVS you are focused on the tail of the distribution. For risk management you're not just worried about how much risk, but how risk impacts your expected value. The final difference is the timeframe, where risk management is worried about today and UVS is worried about tomorrow.

Risk management that parallels the UVS vision is here today and it is being implemented. It's being implemented in a regulatory context in some aspects in Canada, whereas, in the US UVS is way off. There's an interesting contrast between the two, and we should keep that in mind.

A basic premise is that risk management is an offensive tool. It's not a defensive tool. Most companies use it that way, but it's all about offense. It's about creating shareholder value, and it's all about making the right choices. You need to make the right choices on things like distribution, products, what market segments you want to attack, what products you want to focus on, your philosophy toward pricing, how much risk you want to take, how much capital you have, and how much intellectual investment do you want to make.

On a lot of those items, it's really hard to differentiate. It's really hard to get a leg up. It's awfully hard to somehow gain more distribution than the next guy. You're all fighting for the same distribution. It gets really tough. How can you make your product better than somebody else's? The points of differentiation are becoming finer and finer. You need to look for opportunities where you can get a clear advantage. The premise that I'm going to make is that using risk management as an offensive tool, at least for some period of time, will allow some companies to gain a competitive advantage. It's all about making the right choices and having the right information to make those choices. The other option is to be lucky. Given the choice between being lucky and being good, I'd rather be good.

There are many drivers of shareholder value. We hear about it all the time. But at the end of the day, it's not just the value, it's the value relative to the risk assumed. We also have to deal with all of these other annoying things, like how much perceived risk there is. Sometimes the perception of risk is less than it should be and sometimes it's more, and it impacts value. If it's less than it should be, eventually they figure out it should have been more, and it has an impact on your value. Don't lose sight of that. Your ability to respond to perceptions about risk gets to the point about having the right information. And the volatility of your earnings also is a value driver. Optimizing value is creating the highest value for the risks assumed by the organization as a whole.

It's classic finance, but we don't currently run our businesses that way. I'm suggesting that we should be more focused on running our businesses that way. It's my premise that if you're going to optimize value versus risk across your entire organization, you're going to win big because you're going to be making the right choices on much better information than other people have. So we're moving to a new paradigm, where the old paradigm was risk management with a focus on mitigation. Value was determined by assessing the relative cost of a mitigation action. We might need to hedge that exposure because it has too much current income impact or we give away too much in terms of our expected value. The other option is to go naked. Okay, we've been there, done that.

Historically, we've had a tendency to have a silo mentality. We have a risk issue with a particular line of business. We analyze the risk and make decisions in the context of that line of business. The new paradigm changes that. Risk management is now presented in terms of evaluating and capturing opportunities, evaluating the relative risk versus reward of those opportunities in an enterprise context with the goal of optimizing shareholder value (Chart 1).

Let's consider an efficient frontier with a sub optimal value of X. I will argue that many companies in the financial services industry, not just the insurance industry, are at position X. They aren't optimal. They aren't optimal for a variety of reasons, many of which I've touched on already today. The goal is to either reduce risk or increase return. You want to be on that efficient frontier. Frequently, we do things that cause us to move away from the optimal result.

We can't talk about transitioning to a new paradigm without understanding the old paradigm. Currently we assess risks by business line. We're really not worried about how the risks that we're trying to assess in the context of, let's say, variable annuity guarantees, interplay with the risks that we might have in our deferred annuity business or how it may relate to our universal life business. I'm not trying to provide a blanket indictment, but generally, as a rule, we tend to look at things one at a time. We tend to evaluate. So the question is, how much risk do we have? Then we evaluate our tolerance for risk. This allows us to set strategy, primarily at a product line or a line-of-business basis. Then we act, and the action is oriented toward mitigating those risks. We might have a swaption program, an interest rate cap program, or a dynamic hedging program, all designed to reduce our exposure to a particular risk. In doing so, we generally have reduced our overall expected value. Then we monitor for effectiveness and start all over again.

The new paradigm has a different mindset, a different approach. You want to identify the opportunities, synergies, and optimizations. What are the things we as an organization can do to improve value relative to the risk that we're assuming? This is a much different mindset. In the broader context of the entire organization, is it a big deal? How can we optimize what we're trying to do? You identify those opportunities. You evaluate them from a risk/reward perspective across the entire organization. You do sensitivities and stress testing, then you set the strategies. Next, you act by implementing them. The behavior is designed to increase value relative to the risk that you're assuming, not necessarily to reduce value and mitigate risk. Finally, you reevaluate the effectiveness of the process and the impact of changing conditions.

The key elements are holistic view and an infrastructure that can support this paradigm. It requires a new modeling paradigm. You also need the organizational structure. In some of the larger companies, when you ask to speak to the chief risk officer, they know what you're talking about and actually can send you to that person's office. Frequently, those chief risk officers don't have CRO after their name, based on my experience. There is a perception on the part of the insurance industry

today that risk managers, if you're looking for them, can be found in the banking industry. When I visit some of the companies that I'm working with, I'm dealing with risk managers who are from the banking industry. They wouldn't know whole life insurance if they saw it and behave as if it's going to take them 50 years to understand it, but they're the chief risk officers. Why isn't the actuary? There are many talented actuaries in these companies who aren't being recognized as chief risk officers. You will want to think about that because there are a lot of things that are causing that to happen.

I find that the companies that are moving toward the organization that I described are the ones where they do have a chief risk officer, where a corporate centralized function is driving the risk management process. It's breaking through the product line silos. Remember that there's a culture in companies today in terms of organizational structure that prevents pulling it all together and taking a total company view.

Responsiveness focuses on providing information on a timely basis. We need to be thinking in terms of having models built, updated, analyzed, and assessed in days, not weeks or months. Many times opportunities will be very short windows of time that are provided by the capital markets or other environmental situations and require a quick response. You need to take advantage of them by having the ability to evaluate, assess, sensitize, stress test, develop the strategy, and implement in relatively short periods of time. Finally, you need to change the culture of the organization. They're changing their thinking from, "Oh, my God, we can't do that because it's too risky," to, "Gee whiz, that's a great idea. Is there a way we can make it work and create more value for the organization for the risk that we're going to assume?" It's very much a mindset issue. You need to change and move that environment. It seems to be a very big challenge, but it's not as hard in my mind as you might think to create and gain a real advantage.

Here are some examples that I've experienced. One company pursued a market opportunity with a product that no one else would consider because everybody else thought this was the riskiest thing since rolling dice in Las Vegas. When you really understood it and put it in the right context, given that you're going to be rewarded for the risks that you assume and looking at a total company context, it was not a bad thing to do.

Another example demonstrates that sometimes you can reduce your mitigation costs by accepting risks. If you look at them just in the silo context, you wouldn't want to do it. If you were a stand-alone company and that's the only product you issued, it is suicide to offer that product. Even if you're getting compensated well for it, it's suicide because the tail events are so horrendous that you couldn't afford to do it. Yet when you look at it in the context of risk to the organization as a whole, it has an impact on the company's overall risk position, but not so severe or so significant that it would preclude you from offering the new product. The person who runs that particular line of business may have a lot to say about it, and maybe

we need to find a way to do accounting so that he's not penalized for the corporate decision. But at the end of the day, it might be in the best interest for the organization as a whole.

In the third example we recognize that we don't spend time talking about or recognizing natural hedges. We're out there selling equity-based products. We're out there selling interest rate-based products. We know that those two products are not 100% positively correlated. They're not negatively correlated, but they're not 100% positively correlated either, so they create some diversification opportunities. And there are other products, like term insurance, that are not correlated at all or with some of the other products we sell. So we should think about how the synergies and natural hedges that you have in your business allow you to be more effective as an organization.

I'm going to move into a case study that has a lot of relevance because we're going to talk about the modeling that went behind it. The modeling behind the case study has elements of everything you would do in terms of implementing a UVS-based valuation.

Let's define some terms. What is financial risk management? For the moment we'll exclude nonfinancial risk exposures. We're going to take a holistic view. We're going to do risk attribution. In other words, not only are we going to ask how much risk do we have in total, but how much is coming from each of the different risk elements? Generally, each risk is going to be defined by some statistical technique that's based on either historical experience or your expectations to the future, recognizing how each of the different risk elements are correlated with each other.

The risk elements that we're going to use in the case study are interest rate risk, equity market risk, credit risk, mortality risk, and lapse risk. And if you think about it, the main one that's missing is liquidity risk. You could bring a number of other items in. We're going to use a metric that's a little bit different from what you would use in a UVS context. In a UVS context you'd probably be worried more about an embedded value-type measure. Here we're going to look at an earnings-at-risk measure. We're also going to look at risk in some discrete horizons at one, five, and 10 years. I left out the 30-year time horizon because I want to dispel the notion that you can wait 30 years for risk to materialize. Risk is today. CEOs love risk discussions in the context of what can happen to you and what could impact earnings over the next time horizon. If you talk to them that way, maybe then they'll say that this person should be the chief risk officer. One, five, and 10 years provide different horizons to gain different perspectives. I'm not saying you shouldn't look at 30. Bring it in. It's important. You should look at it. But you don't want to be insolvent after five years, even though you felt okay after 30.

In any stochastic process, you run hundreds or thousands of trials and you produce a metric. It could be earnings over the one-year period. It could be the sum of earnings over the horizon. It could be an embedded value-type measure. For any

metric you want to use, you produce a value for each of the scenarios that you've run. You can then rank order them from highest to lowest and you get a distribution (Chart 2). You have the expected value and you have percentiles in the distribution. My definition of earnings-at-risk is the difference between an expected value at a particular point in a distribution. So the fifth percentile earnings-at-risk will be the difference between the mean value and the value that's produced at the fifth percentile.

I want to talk now a bit about stochastic elements and a little bit about the generation techniques. I want to talk about interest rates and equity generation together because they're highly integrated. We use an interest rate generator and a capital asset pricing model (CAPM) approach to develop sub account returns for the variable annuity that's included in this case study. That allows us to generate specific returns for large cap, small cap, international, bond, money market, and whatever other asset classes you choose to model. We generate interest rates, particularly a short rate. We incorporate an asset class-specific risk premium that's based on historical data for each of the asset classes and a corresponding volatility. We use a correlation matrix and a decomposition methodology to then make sure that the returns that we're producing for the different asset classes are fully correlated with each other and with interest rates. That allows us to build a fairly robust scenario generation technique and to capture into that scenario generation process the underlying correlation between debt and equity markets and the different asset classes, including factoring through basis risk as it impacts the products that you're modeling.

On the credit side, there are a number of methods you can use. We used a fairly simple one to illustrate the approach. We looked at historical default experience by rating level and fit that experience to distributions, using a mean and variance. The distributions are not normal in any way, shape, or form. Default events tend to be low frequency, high severity as a general rule. The distributions that we developed have those characteristics.

We didn't try to correlate our credit events with anything else. In a more sophisticated exercise we would consider linking some of the credit events to the underlying equity markets, for example. There are many people out there promoting those ideas and snapshot valuations and credit risk valuations in the context of equity market moves. We're trying to model credit events, but not in the next 90 days or the next year. We're modeling credit events out over a much longer time horizon, but it can be factored in. For this purpose, it's not correlated; it's an independent event.

For mortality we did two things. We have both systematic and nonsystematic variation in here. We have the pure probability that you're going to have this spike up in death claims that you all deal with or management asks you about. We also built in a bias toward mortality deterioration over time just to play with the modeling and understand it.

For lapses we used nonsystematic variation about the base lapse assumption. We could have been more sophisticated. We could have said we have baseline lapses and dynamic lapses. But what if we're all wet on lapses and what if we had this alternative model for lapse with a probability associated with it? We could have modeled that as well. We didn't, for a variety of reasons, one of which is just the time it took. As you can begin to see, we're doing a lot of stochastics.

In our case study we included all in-force liabilities. We're going to use a block of universal life (\$500 million), variable annuities (\$800 million), and bank CDs (\$500 million). We backed the UL block with corporate bonds and mortgage pass-throughs. For the bank CDs, just for fun, we backed them all with mortgage pass-throughs. I know that's not the right thing to do, but let's have some fun and do it. The variable annuity block included a five percent roll up guaranteed minimum death benefit.

Table 2

FRM Case Study - UL Results (5 year)

<u>Percentile</u>	<u>Total</u>	<u>Lapse</u>	<u>Credit</u>	<u>Mortality</u>	<u>Interest</u>
1 st	(\$12.1)	\$20.8	\$13.8	\$9.5	(\$0.5)
5 th	1.6	21.1	16.3	13.9	5.5
25 th	9.0	21.4	18.0	18.6	12.9
50 th	14.0	21.6	18.9	21.6	18.8
75 th	18.6	21.8	19.8	23.4	22.5
100 th	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 results are presented in Table 2. The metric we're using here is statutory earnings. We could also do this on a GAAP basis. We looked at statutory book profits year-by-year for each scenario. We added them together, so there's no discounting and no accumulation.

Let's talk about the total column results. We set the model in motion. Interest rates, sub account returns, credit, mortality, and lapse were all stochastic. The result is this distribution of outcomes, with an expected value of \$12.1 million of earnings over the five years. This is a little more than \$2 million a year. The 50th percentile is \$14 million, so there's some "skewness" to the distribution. We could

make as much as \$30 million over that five-year period, which is two-and-a-half times the expected value, and we could lose as much as \$12 million. The earnings-at-risk measure that we're using is the mean minus the fifth percentile. So we have a five percent probability that we could earn \$10.5 million less than our baseline mean estimate of \$12.1 million.

Let's discuss the other columns, starting with the interest column. In generating this result, the interest rates were the only stochastic variable. There are different ways you can get at these numbers, but here is the approach we used. It's an acceptable approach. Interest rates were stochastic. Everything else was not. We used expected default rates, so the means of the credit events were being applied. They were not being randomly generated. We had expected lapses. We had expected equity market returns, using the mean of the sub account returns that we're using in the modeling. Interest rates were stochastic, and we produced this distribution of results. You do the same thing for mortality, credit, and lapse, and you get different values and different amounts at risk.

It is interesting to note for the earnings-at-risk amounts that when you add them up they are much larger than they were when everything was stochastic. That gets to the fact that the risk events don't all happen at the same time. They're not fully correlated. When you're up against the minimum guarantees, it isn't necessarily the same scenario that causes the worst credit events or, for that matter, the scenario that produces the worst mortality event. So you wouldn't expect the at-risk amounts for each of the risk elements calculated independently to add up to what they would when you consider them in aggregate. This follows the synergies in the context of a valuation system. One of the things I theorize often about is: will the regulators actually be happy when they realize that the company doesn't need to hold any capital because they have all of these uncorrelated events that factor through into very low capital use? It's actually good if you can convince the regulators.

If you compare the uncorrelated total of \$21.0 million, adding up the different earnings-at-risk pieces measured independently against the total, the difference is the correlation effect. You can think in terms of risk attribution. I did it on a before-correlation-effect basis. There are also techniques, if you remember your probability and statistics, that allow you to get these percentages on an after-correlation effect. They'll be slightly different. We see that 50% of the total risk exposure is coming from interest rates and, because of the mortality deterioration assumptions, 38% is coming from mortality. Credit risk is a nonevent.

Table 3

FRM Case Study

<u>Risk Element</u> Contribution	UL	VA	CD	UnCor.	<u>Cor.</u> 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	<u>(10.5)</u>	<u>(2.6)</u>	<u>(0.1)</u>	<u>(13.2)</u>		<u>(22.9)</u>
Correlated Total	10.5	12.6	6.1	29.2		17.3

Table 3 shows the results across product and risk element. If we look at a variable annuity block, to no one's surprise, on an uncorrelated basis we have \$15.2 million of total earnings at-risk exposure, of which \$13.1 million comes from equity markets. You will recall that this block has \$800 million of in-force amount versus \$500 million on the UL block. There is some interest rate exposure inside a variable annuity contract, even if you don't have fixed elements and you have small amounts of lapse and mortality exposure. There is a fairly small correlation contribution because it's mostly equity risk across the product for a total of \$12.6 million. The CDs are driven by interest rate risk. Small lapse. We didn't have any credit risk in the assets and that produces \$6.1 million total earnings at risk.

On a fully uncorrelated basis you have \$42.4 million of at-risk exposure across all products. Five percent of the time you would expect to be \$42.4 million away from the mean. I didn't tell you what the mean was. I will, but it's part of the punch line, so I can't just give it to you. At the end of the day, when you factor in the correlation effect across the product lines and across the risk elements, you end up with \$17.3 million of total risk exposure, which is less than some of the individual contributors on an uncorrelated basis. You have about as much interest rate risk as you do equity risk exposure. You don't have much credit risk. Don't forget that we're looking at this over a five-year horizon. You have some lapse exposure. If you recall, I'm just doing a statistical variation on the lapse, so you wouldn't expect it to be a large number. The mortality is material because of the way we've modeled the mortality and the expected mortality deterioration.

Now let's look at the distribution of value, using the base sum of five years worth of statutory earnings rather than the at-risk amounts. The mean is \$34.7 million, which means that I have a five percent probability that I could lose half of my expected value ($34.7 - 17.4 = 17.3$). It could be as large as \$62.1 million and as little as \$1.1 million. There's some skewness to the distribution, which is why the median is a little larger than the mean.

Let's address the same values over a one, five, and 10-year time horizon. There are several observations worth noting. In a one-year time horizon your equity risk and credit risk exposures are a greater proportion of the total than they are as you go out over time. That's not surprising. In fact, the key here is to realize that we want to hedge out the one-year exposure while taking a much larger position on credit over the longer term. Is that going to optimize value? That's the kind of thought process that you really want to use. And now you have built a platform for evaluating the design of a hedge program to protect against the one-year downside credit event while taking the greater risk exposure and see how it plays through the models.

Over time the equity and interest rate risks even out. The credit risk starts to stabilize over time. Mortality is about the same on a per-unit basis period-to-period. It's interesting to look at the correlated total per year. On a per-unit basis your exposure in total doesn't change that much, but the relative contributions from different risks is different over time.

I can see conversations with management concerning whether we really want this much equity risk exposure versus interest rate. Are we taking enough credit risk exposure? It's important to get the models right. Of course, the more sophisticated you get these models, the more model risk and assumption risk you have. You end up with a different set of problems.

Now let's look at a second case study, change the mix of business, and see what that would do for us. The new mix is \$400 UL, \$1300 VA, and \$100 CD. At the end of the day the risk amount hasn't changed in aggregate. You certainly have a lot more equity risk than you had before, so you might want to start thinking about how concentrated you are in terms of equity risk. You have reduced interest rate and credit risk. Lapse risk is actually higher, due to the underlying lapse in the variable products. Mortality, of course, is lower.

Should this adjusted mix of business be encouraged (\$400 UL, \$1300 VA, \$100 CD)? I have a little more concentration in equity market exposures, but it's about the same risk position overall (Table 4). The problem is—look at what happened to the mean. Now we're losing \$17.9 million of the \$25.6 million mean versus \$17.3 million on a \$34.7 million original mean with a five percent probability. Our expected values in here are generally lower, but not dramatically so. What happened is that the tail of the distribution got a lot worse. So if you think back to the risk/reward relationship, have we moved up and to the left? I don't think so. I

think we moved down and to the right. What we're really trying to do is move in the other direction.

Table 4

FRM Case Study

<u>Percentile Distribution</u>		
<u>Percentile</u>	<u>New Mix Value</u>	<u>Original Mix Value</u>
0 th	(\$20.4)	\$1.1
5 th	7.7	17.4
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

Risk management is a competitive advantage. Do you want to be good? Do you want to be lucky? Do you want to make the right choices based on the right information? The technology exists today. The modeling capability exists today to start using these tools to create information, to present it in the proper way to management to help them make better decisions and gain a competitive advantage.

MR. MAX RUDOLPH: Frank, you talked about doing some internal insurance for various risks where you are saying that the enterprise could take that risk, but the individual product line couldn't. Are you seeing a lot of companies doing that? My company does it for default risk. The product lines don't actually invest the dollars, so we try not to make them be responsible for credit risk volatility. In the places where you do that, how do you continue to have the proper incentives to make sure it's properly priced if the corporate line is, essentially, taking that risk?

MR. FRANCIS SABATINI: I think people are starting to look and think about internal insurance. We're also frequently looking at risks that have fairly large tail events. If you look at just that particular product or product feature on a standalone basis, you might say that you're getting some substantial revenue but you're taking a lot of risk. And the tendency is to focus on the risk and not focus on the value. The point I'm making is it's not necessarily underpriced relative to the value that's it's getting after considering the risk.

You could do a Sharpe-type ratio to compare products. There probably are other products in the company with worse risk profiles than some of the product lines being considered for divestiture. They're just not being looked at in that way. So when they get around to looking at that exposure in the context of the entire company, you might find that it is a risky product. But it has a pretty good risk/reward relationship. The risk exposure in the tail may be pretty scary, but when I look at it in the total company context, it's not a big deal. The conclusion would be to issue the product.

MR. ALLAN BRENDER: I have two comments. You both mentioned low tail probabilities. We're used to believing in the central limit theorem concept and in the fact that the more you sell, supposedly, the more stable things are. But the kinds of risks that occur in the tail are usually, in fact, things that are not diversifiable. The more business you sell the worse it is. So it's not about mortality, it's about features like guaranteed minimum death benefits where we are making capital guarantees. What happens when the market tanks? It hits every one of your contracts. The same phenomenon happens to P&C insurers with hurricanes. Everybody in a certain area is hit all at once.

MR. ROBERT WILCOX: I agree with you 100%. The point I'm trying to make here is that if all you sold was guaranteed minimum death benefit contracts, that's a scary situation. But if it's 20% of your in-force, maybe you shouldn't be losing as much sleep as you are and you should look at it that way. Not only from a risk management and a valuation creation perspective, but also from a valuation perspective.

Chart 1

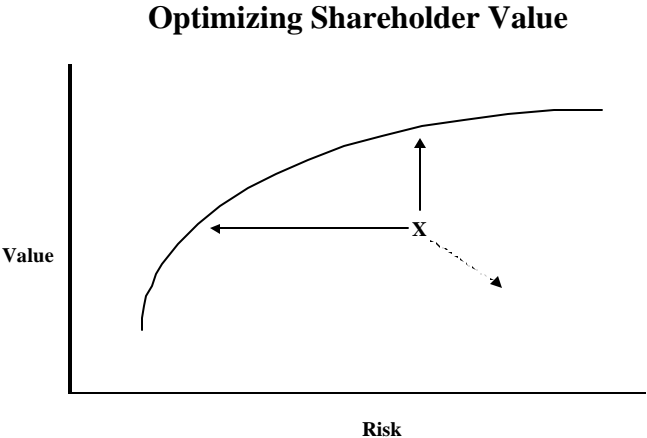


Chart 2

Earnings at Risk (EaR)

