

# 2004 Valuation Actuary Symposium \*

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## Session 29PD Integrated Risk Management

Moderator: Michael O'Connor

Panelists: Tony Dardis  
Francis P. Sabatini

*Summary: In the past, risk management has not been an integrated process in insurance companies. Changes in the financial industry refocused management attention to risk management. Management is starting to develop new ways to examine financial risks holistically in an integrated model.*

**MR. MICHAEL O'CONNOR:** Our first speaker will be Tony Dardis, a member of Tillinghast's Dallas office who specializes in risk management. He has extensive overseas experience, is experienced in the investment-banking world and is a chartered financial analyst (CFA) and an FSA.

The second speaker will be Frank Sabatini. He's a partner in Ernst & Young's Hartford office. He's on the Risk Management Section and, effective with the annual meeting, will be the chairperson of the Risk Management Section. We'll start off with Tony.

**MR. TONY DARDIS:** It's good to be talking about risk management, one of my favorite topics and, in particular, integrated risk management. It was interesting, having been away, to see how things had developed over the past three or four years. Perhaps not surprisingly many of the same issues are still there. Questions remain about establishing a common language and establishing risk matrix and, in particular, issues over getting senior management's, boards' and executive committees' buy in. I think these are all similar issues that were there a few years back and are still there today.

However, there are some very exciting new developments that have recently

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

emerged. First is the emergence of the chief risk officer (CRO) as a position of some strength and power within an insurance organization. And there's also the creation of the new Society of Actuaries' Risk Management Section, which I think is a very exciting development. But I think most of all what has really excited me on my return to the United States is seeing how stochastic modeling and stochastic modeling techniques are now pretty much bread and butter for valuation actuaries.

Before I left for South Africa, C-3 Phase II didn't exist. I think what's very exciting is that you can see the techniques that have been established or are in the process of being established for variable products feeding into all product lines as we go forward. I think that's a very exciting development in the United States, which will parallel what's happening from an international perspective.

Because integrated risk management is a very broad topic, in the short time available Frank and I can really only touch upon a few topics. I'll cover three areas. First I'll talk about some of the corporate governance aspects of integrated risk management. Then I'll talk about setting consistent assumptions across the organization for marketing purposes. Finally I'll talk about operational risks, or non-financial risks, which is an area a few years back we didn't get involved in very much as actuaries. But clearly this is becoming a very important area. So let me talk about some corporate governance aspects.

For those of you who aren't necessarily convinced that integrated risk management is important, I think you just have to look at the developments both internationally and here in the United States. There have been a number of very high-profile insurance company failures in recent years. You just have to look at the Equitable, one of the finest financial institutions in the United Kingdom that was closed to new business a few years back. Part of the reasons for that had to do with risk management and corporate governance. Mis-selling and market conduct issues in the United States obviously have been important features of the U.S. markets in recent years, and again, some of that ties back to corporate governance. Sarbanes-Oxley obviously will have an impact. Last but not least, the regulators, the rating agencies and investment analysts will give an insurance company credit now for good corporate governance on the risk management side, so that in itself is an important reason for looking very closely at integrated risk management.

Chart 1 looks very complicated, but actually it's not too bad at all. It's fairly straightforward. It's surprising how in practice, if you go into an insurance operation, there are parts of this that are still not quite there. You see some problems still there in insurance operations. What I'm trying to demonstrate is how important it is to identify where your risk exposures are and that in turn can help you with your integrated risk management processes. So I split this up between a line-of-business level and the corporate level.

At the line-of-business level, asset liability management (ALM) is occurring. I'll make the distinction between ALM and risk management in a moment because I

think there is some confusion over the definitions of those terms. At the line-of-business level, it's important that you do ALM or, in other words, manage the financial risks. The results of that work should then feed through to the corporate level, where you should have both an asset liability management group and then a risk management group.

What's the distinction between the ALM group and the risk management group? The ALM group focuses on financial risks. The risk management group looks at broader risk management issues, such as non-financial risks and operational risks. They look at the picture overall for the corporation. In practice it's interesting to see how there are issues over understanding where to put the risks because this, in turn, should help you determine what committee structures you put in place and what risk management and ALM structures you have in place.

Just to feed into that, Chart 2 is a very simple risk management structure. I'm just looking at a single business unit, and that feeds through risk features to the risk management committee or the CRO at the top here. In turn, this information is fed through to the investment committee, and then the business units will also be feeding information through to the asset liability committee, perhaps through the asset liability manager. And then the communications go through to senior management, to the executive committee and to the board. So you'll see in a sense that you have these critical committees that are collecting information, synthesizing it and then feeding it through to senior management.

I hope you can see that in establishing an appropriate corporate structure, you have to understand Chart 1 and how risks can be differentiated. This is just an example. There's no such thing as one size fits all as far as this sort of thing is concerned. You have to look at your particular company's circumstances. Obviously, for a smaller company you wouldn't want such a sophisticated arrangement.

Chart 3 is a terribly complicated looking chart, but actually it's not too bad at all. This is really just saying, what's the purpose of integrated risk management? There are two sides to this. You have a need to understand what your risks are across the organization. You then have strategies that you'll look at, which is part of the course of running your business. You bring the two together to manage your risks with the objective of increasing the value, which means enhancing growth, increasing returns and improving consistency of returns. So that's the objective of integrated risk management.

Chart 4 is a simple example of an exercise that you might do as part of integrated risk management. This is essentially what C-3 Phase II does in terms of running a model over many stochastic scenarios, ranking the results and then looking at the tail end of the distribution. This is an integrated risk management process that you could adopt for establishing capital for the corporation overall. You could go through a process of ranking the present value of future profits that comes out of the different scenarios, and you may then determine that you have a certain risk level

and you want to establish capital to make sure that you don't have to dip into more funds, say 5 percent of the time. So this kind of thing is exactly what C-3 Phase II is doing. I've just put Chart 4 up here as an example of a process that you might use as part of your integrated risk management work.

Finally on the corporate governance side, I just wanted to say a couple of words about the emergence of the CRO. This is clearly becoming a very important position for insurance companies. It's interesting to see that 45 percent of CROs worldwide are now working in financial services. Energy and utilities account for 40 percent of CROs, and then there are 15 percent in other industries.

The key CRO responsibilities include centralization and coordination of all risk management activities, implementing the risk management framework and then finally communicating the results of integrated risk management work to the board. Clearly the CRO is a key conduit between the integrated risk management work and the board and the executive committee. Just to emphasize the importance of this position, CROs typically report to the CEO or the CFO.

I'd like to say a few words about consistency of assumptions in methodology. Just thinking about the broader issues when we look at all the risks facing an organization and the importance of having consistent methodologies and consistent assumptions, for me it really gets back to the idea of a traditional corporate actuarial department that was responsible for setting global actuarial assumptions, which would then get fed through to the lines of business. The corporate actuarial function would also establish principles that would be used by the lines of business for setting line-of-business-specific assumptions, such as mortality. The principles are exactly the same when it comes to broader integrated risk management, so a lot of this stuff is pretty obvious. It's very akin to what's always been done by a corporate actuarial department. It does cover broader risks, but again, in practice there are issues over some of this stuff in terms of ensuring good communications.

Chart 5 emphasizes this whole question about how it sounds easier than it is in practice. The corporate-level risk management units need to be responsible for setting assumptions, such as economic assumptions, that will be applicable to all lines of business, and then also for laying out principles to be used in setting line-of-business-specific assumptions. That's what is fed through to the lines of business. They run models and produce results, and then obviously that is fed back to the corporate unit to synthesize the results and to look at covariance effects when you bring together all the different lines of business.

Chart 6 lists some of the risks that you need to look at. I've made a distinction between those that would be set globally versus line-of-business-specific risks. The different risks are market risk, credit risk, insurance risk, business risk and then the non-financial part—the operational risk. Clearly, as far as market risk is concerned, that covers your economic assumptions. That's something that must be established at a global level. Credit risk, similarly, is an assumption that should be set globally.

Insurance risk is clearly a line-of-business assumption. But as I say, you need corporate-level guidance as to how to set these assumptions as far as integrated risk management is concerned. And then business risk—new business volumes, etc.—is clearly a line-of-business-specific assumption. We'll get to operational risk shortly.

So here's the gamut of risks that you need to look at. Then critical to all of this is that you bring it together, and you have to identify where correlation and covariance effects are occurring. These risks can't be looked at in isolation. That's at a line-of-business level, and then obviously you feed that through to the global level and then again, you have correlation and covariance effects to look at.

Chart 7 is my final chart on assumption setting. I think it's instructive to consider how you model some of these risks. In terms of what's developed by an economic scenario generator, obviously the market risks would be done entirely that way. Counterparty and credit spreads would be also a result of your economic scenario generator. Parameter distributions would be claims volatility. Formulaic relationships would be policyholder behavior, new business volumes and expenses.

That's all I wanted to say on assumptions. It's pretty straightforward. The issues come when you try to implement this in practice.

Let's talk about non-financial risks, or operational risks. There isn't a standard financial services definition of operational risks. The Basel Committee on Banking Supervision does have a definition that is used quite regularly: the risk of loss resulting from inadequate or failed internal processes, people and systems, or from external events.

I want to refer to a survey that the Society of Actuaries did in 2001. That may seem like quite a long time ago, but this was a major survey that involved a tremendous amount of detail on risk-reporting processes. There were a number of questions in that survey that looked at operational risks. I do want to refer to the survey because I think it is a benchmark for what companies are doing on the risk-reporting side. It's probably coming to a time when we need to redo that survey now, but this is the best we have for the moment. And the reason I'm mentioning it is there are a couple of things that came out of the survey that I think are of great interest.

The survey did define five different types of operational risk: event risk, people risk, technology, distribution and catastrophic. I think this is just indicative of what companies could use in terms of when you actually look at your specific risk profile. You don't have to use these particular definitions, but it is something that works as a fairly decent guideline. Just to stress the importance of some of these operational risks, I've bolded in Chart 8 some of what came out of that survey. Different operational risks showed up as being very important. Regulatory intervention was kind of in the same ballpark as liability claims cost and catastrophe risk. So I show

you this to indicate how important some of these risks are perceived to be by companies.

It's important to stress that operational risks do vary considerably based on a company's internal operations, so we can't give sort of general guidance as far as operational risk assessment and operational risk management is concerned. You need company-specific data, and the data must be representative of your current operational environment. It is critical that operational risk assessment does tap into the knowledge of experienced managers to supplement role data. I'll say more on that in a minute.

In terms of quantifying operational risk, you can look at this as a six-tier process. First, you need to agree on the basics—what risk will be assessed and over what time period? You don't necessarily want to cover everything in that assessment. Having done that, you should then review your business processes to identify risks. If you consider, for example, the process of selling a product, you may have a number of different processes that are involved in getting the product designed and getting it out to the market. Once it's on the market, you then have a number of other processes that, in turn, can lead to a variety of potential risks. The idea of a process chart is to establish from the process where these risks do lie. For example, as far as selling a product is concerned, the identification of market conduct-type risks might come out of examining this process. The idea is that this is something that senior management can sit down and look at, as far as all their major processes are concerned, and that, in turn, can help identify the underlying operational risks. It's fairly straightforward, but in practice there are certainly issues over some of the subjective issues that lie behind this.

Having done that, you then will need to try to collect frequency, severity and correlation data, and this gets to the heart of the issues around modeling operational risk. The sort of data that you might have for an operational risk are typically low-frequency/high-severity type circumstances. You might have some data that has a few points down at the lower end of the distribution, and then you might have a fairly large loss that has occurred in the past, and the question is, how will you model this? Clearly judgment and expert input is absolutely essential. You can't just use the history in this instance to develop a model. So the type of thing that you might see is that expert judgment might say that about 66 percent of the time, you'll get a zero loss from this event. And then your expert judgment might say you have some sort of distribution that looks like that. Maybe that occurs 33 percent of the time. This big loss up here is something that just occurs, say, 1 percent of the time.

Now again, this is straightforward. But you can imagine there are tremendous difficulties in establishing loss distributions when you have such scanty data. This gets into some of the complex technology that you may have read about in terms of neural networks, Bayesian techniques and the Delphi method, which I'll return to shortly. Some of these techniques are very complex. But in fact, you can get by

with sound judgment and a decent spreadsheet tool in developing something that is still useful.

Step four is to screen out your immaterial and manageable risks. You don't need to worry about those. Step five is a very interesting part of the exercise. You all get together. You've done your frequency and severity analysis. You have your expert input. Then you need to get all your senior management together and basically have a challenge session. At that point, you're already finalizing what you'll do in terms of managing or perhaps setting up capital for these risks.

The last question on the challenge session is usually, was this a difficult exercise? And if people think it was a straightforward exercise, then you probably haven't done your job. Finally, having gone through all that, you can get on with your modeling.

I'd like to just mention different types of operational risk assessment that you can do. Again, this comes out of the work that was done by the Society working group that looked at risk reporting. There were five different approaches that the working party looked at. I think it's important to show these because a lot of thinking went into this. We looked at what the market was doing, and these were the different methodologies that were established.

First, just looking at your historical data blindly won't work necessarily. Second, you can use a probability distribution, so you might have a preconceived idea as to how these operational risks look as a distribution. Third, you might want to use your historical data to establish regression analysis. Influence diagrams in the Delphi method just look at cause and effect relationships, which gets back to the previous chart I had that said look at your processes and look at where the causes and effects are occurring and what some of the financial outcomes are.

Then finally the Delphi method, I think, is one of the best ways forward. But it is surprising how little this approach is used. It involves a group of senior management getting together and being interviewed on processes and, from those interviews, establishing what your risk exposures are. Having collected that initial set of results, those then are fed back to the group again. They can then change their views in light of the initial set of results. It's interesting how often that does happen. There are things that one person may not have thought about for the initial round. It gets sparked off once they see what other people have said. This is done on an anonymous basis to help the process.

You might find this of interest as far as what companies are actually doing. Going back to this survey, we found that of the 44 companies that were interviewed as part of this survey, 17 said they did some sort of operational risk assessment. It's not a huge number. I think that would have gone up, however, by now. Of those 17, 88 percent used empirical valuation and 35 percent used probability distribution. You can see those other three methods that we looked at are not really

used at all. In fact, influence diagrams and the Delphi method didn't show up at all. I know for sure that will have changed now. I think some of these techniques are definitely being used by companies.

So just to finish off, operational risk assessment is important. It does help you understand the workings of your business and the workings of your business processes. So even if you don't establish capital in respect to these studies that you do, it does at least help get you focused on what your underlying risks are.

**MR. FRANCIS P. SABATINI:** Times change. I've been around for a while. The world we live in has changed. I remember five or six years ago when risk management wasn't a hot topic. We didn't have a Risk Management Section. For insurance executives, risk wasn't on the radar screen. We had a 10-year bull market. Ten years. We had almost a 10-year secular decline in interest rates, and for the insurance industry that was great news. We didn't know they'd go as low as they did. But balance sheets were pretty clean. We lived through the collateralized mortgage obligation (CMO), and we cleaned that up. We got rid of the high-yield bonds. We were doing all right. We'd been doing ALM for years. Everybody knows how to manage interest rate risk, we believe. But what's happened?

In a matter of four or five years, all of that's changed. We've had historically low interest rates. Remember interest rate guarantees? Three percent—who would have ever thought that we would have had any kind of spread compression from those guarantees? And that's still a risk today. We've had one of the worst bear markets in the history of the stock market. We continue to have our sort of cyclical credit events, but they're just as painful every time they happen. And of course, we've been working hard to make even better and more meaningful and more significant guarantees on our products. That's not necessarily bad if we know how to manage the risk on those products. And to make matters worse, the rest of the world is starting to pay attention, and they want to know how you're managing risk on your balance sheet. The analysts, the rating agencies and even the regulators do. So there's a greater desire for transparency. Even management wants to know.

The game is being redefined. What else is new? As Roseanne Rosanna Danna used to say, "There's always something." Now we have external constituents asking us questions about risk on our balance sheets, and they are very focused questions. I'll give you a story, and I won't mention names. I was at an analysts' conference, and I was a speaker at the conference. One of the speakers at dinner was a CEO of a very large insurance company. The analysts started asking, about every third or fourth question, "What are you doing you manage the risks on your guaranteed living benefits?" This is a CEO of a company that had a huge balance sheet. The guaranteed minimum income benefit (GMIB) exposure was next to nothing, but they had to deal with this because the analyst community was focused on that one issue. And they continue to do that—just listen in on some of the analysts' calls.

That creates pressure on management to respond. They end up having a discussion

about risk management out of context. It actually could lead to unnecessary actions. I think, for example, there are probably some hedge programs that were implemented that probably don't need to be, in the context of the overall company's risk profile. In some instances, it's absolutely necessary. But in others, I think it's not necessarily warranted.

What does management need to know or want to know? Probably these days, they want to know more than they need to know, if you understand the distinction. How much risk do I have on the balance sheet? How much interest rate risk do I have on the balance sheet? How many people are from companies whose management knows in aggregate 90 percent of the balance sheet and how much interest rate risk is on the balance sheet? All right, that's not a lot of hands. Three. That goes to the point. I know we're doing it on credit risk. The trouble is that you can't compare the credit risk number that you've developed to the interest rate risk number or the equity risk number. How are the major risk elements represented? That's what they want to know. Is \$1 of credit risk exposure the same as \$1 of interest rate risk exposure? And, for that matter, extend it over to non-financial risk exposure—that's some of what Tony was talking about.

How much benefit do I get for balance sheet diversification? I personally believe that the next wave is having companies get the external world comfortable with the amount of diversification that's on their balance sheets, and it will be used as a competitive advantage. But if you think about the story I told earlier, that CEO couldn't make that claim because he didn't have the information. I'm sure he knows it intuitively. He's sitting on billions and billions of dollars of assets and liabilities across all different product lines, and somebody is asking him a question about a relatively small piece of his business. If he can demonstrate that fact, they should be able to leverage it.

The whole idea of risk tolerance, I think, is another area in which the industry will extend its knowledge base. We'll start answering the question, how much is too much? That's the question that management wants to know, which ultimately leads to the question: Can I take more or less risk? I think to the extent that the companies understand how much risk they do have on their balance sheets, they can decide that maybe they're not taking as much risk as they could or should. And, of course, how can I use risk management as an offensive weapon?

Historically we've created this strategic business unit, line-of-business unit, focus, and we've done a very good job in risk management at the line-of-business level. We've done a very good job of creating these silos. The problem is that putting together a corporate-wide view is difficult because you need to get all the different silos to work together somehow to put it together. What do you need to do? One of the core principles is a need for common measurement system—everybody is doing the math the same way. It examines all financial and non-financial risks. And the non-financial piece is a meaningful challenge. It's not one that we've really taken that far, and Tony's comments were very appropriate.

Holistic quantification, the overall financial risk exposure and attribution—that's the important thing. You talk to people in companies, and they say, "Well, we don't take credit risk. We take interest rate risk," or vice versa. It's all intuitive. It hasn't been measured that way. They couldn't answer the question: How much more credit risk do you take relative to interest rate risk? And in doing the core principles, you need to find a technique of how you reflect the risk in some of the measurement that you're doing. We'll talk about that in another minute.

We'll look at a really simple case study. I don't want you to critique the numbers. It's more just to stimulate your thought processes in terms of how you would go about pulling together an integrated unit. And in this case, the case study will be around financial risk issues, so we won't really talk about non-financial risk elements.

In a simple example, we have a small company with \$500 million in universal life (UL) and \$800 million of variable annuities (VAs) with a pretty simple death benefit guarantee and a bank CD, simply to be different. We're backing the UL with corporate bonds and the bank CD with mortgage pass-throughs. We'll look at five risk elements. I just want to talk a little bit about aggregating interest rate risk. We all have models that can do stochastic modeling of our assets and liabilities around interest rate risk. To put an aggregate position together, all you need to do is run the models on the same day, on the same valuation date, with the same set of scenarios, and add the results together, assuming you have the right metric. You can add scenario one together from the deferred annuity line with scenario one of the UL line. You add them together, and you'll get a pretty interesting risk profile. We'll actually go through that process.

If you then have an equity return generation capability that is, again, correlated with your interest rate scenario generation—and in the case study we'll use the capital asset pricing model (CAPM) approach—now you have scenario one that's both interest rates and equity returns, scenario two and so forth. Now of course, the minute you introduce equity returns, the number of scenarios you have to produce is a little greater than what you might normally be used to. But these days, if it takes too long to run, you just buy more computers.

On the credit technique, we just fitted distributions to historical default experience, and I'm not suggesting that this is the best approach. It's more designed just to stimulate the thought process. There was a mean and then there was a distribution, and they weren't normal distributions. And then we had correlation between rating events bands. We'll talk about it, but basically what I'm talking about is that credit is now a stochastic variable, and it's the same thing with mortality—stochastic variable. We assumed that there's a long-term secular deterioration in mortality, just to illustrate the point.

Normally lapse would be part of your interest rate risk exposure, but what we've

done here is to introduce the idea that you could be wrong about policyholder behavior. This is trying to get at a measurement that says, "What if it's much different than what you assumed?" So it's a variation in the assumption.

Now we're going to use a metric that's earnings at risk in the example, but it doesn't have to be earnings at risk. It could be an embedded value measure. You can use an economic measure. You can even use a GAAP earnings measure. The important thing is that it's a common measure across all the risk elements in all the businesses. In this case, we'll look at a horizon of one, five and 10 years. One of the nice things about using earnings measures is that you can look at risk over different horizons, although I wouldn't want to just stay with earnings for a couple of periods. I'd probably want to look at something like an embedded value measure to get a longer-term view.

This is just definitional earnings at risk. This is a distribution of outcomes from a modeling process. It's rank ordered, lowest to highest, so the yellow line is the mean value of earnings. The red line is the fifth percentile result. The difference between the two in this context is earnings at risk. We ran these models and it's statutory earnings. Over a five-year period, we add them together. We can talk about whether or not you want to accumulate them or discount them, but we added them together, and we rank-ordered the results. Then we were able to produce a distribution calculated mean.

Let's just talk about the interest column first because it's the one that we can relate to the best. We just ran a typical ALM model—assets, liabilities and stochastic interest rates—and calculated the earnings numbers and produced the results. The mortality assumption, the credit assumption and the lapse assumption were all on an expected value basis. We ended with a mean value of 12.9, and the earnings at risk is 8.5, which was basically 12.9 minus 4.4.

When it came time to do the mortality process, we used the single forward curve. That was constant interest rate assumption, but mortality was the stochastic variable. Basically we're just coin flipping from a distribution that we define, so the  $q$  could vary period to period. And, of course, there was a secular trend, so the distribution kept shifting over time towards that trend, and we ended up with a distribution. That's why we end up with so much earnings at risk, because it was just statistical variation. It would just basically reflect the variability of deaths period to period, but in this case, we're reflecting a longer-term trend of mortality.

One of the interesting things about credit is that you end up with a pretty small earnings at risk number. We'll see later that it's a more meaningful number over a one-year period. Over a five-year period, you get the effect of time diversification in terms of credit risk exposure. You don't have credit events every year for five years. You have credit events maybe once every five years. The way we defined the lapse process, there was an alternative lapse function as opposed to the one that we used. That was a stochastic process, so it produces a little variation.

We're not suggesting that these are directionally correct, and a lot of the results you'll see are intuitive. You'd want to spend more time thinking about how you want to approach credit or, for that matter, for assumption variation around lapse.

The "total" column is the result of having everything be stochastic at the same time—interest rates, credit, lapse and mortality. Now it's time for audience participation. What's obvious on this screen?

**FROM THE FLOOR:** The sum of the total doesn't equal the total.

**MR. SABATINI:** That's right. You can talk about diversification of correlation. This is just a restatement of the previous chart, but basically the 8.5, 1.7, 0.4 and 6.2 are all from the previous chart. They add up to 16.8. But the result when everything was running in aggregate is 8.4. The difference is what I'm calling the correlation effect. You can talk about diversification effect. The fact is, the worst credit event isn't going to happen necessarily the same time you have the worst interest rate effect. The way we did the modeling, we assumed credit events and interest rates were uncorrelated. I know there are some of you in the room who have different views on that subject, and we can continue to debate it. It was the same thing with mortality. Mortality is uncorrelated with interest rates, so you end up with a significant correlation effect.

So the conclusion is, the business isn't necessarily as risky as we thought it was. Now you do it for all three product lines, so we go through the same process for the VA block and the CD block, and we get an uncorrelated total of almost 43. Let's think of it as millions of dollars. Yet when you look at the correlated result, it's 18. You can't ignore the fact that if you end up with worst interest rate event, you'll get the 11.8. This isn't the greatest example, but clearly within the VA line there isn't really much correlation benefit. It's all equity risk, right? At least you can look at it and say, "Well, for this particular business, 50 percent of the risk is equity-based risk before adjustment for correlation." There are ways to adjust for the correlation effect.

How do each of the risk elements contribute to the 17.9? I don't think I have that slide in here. But you can now start having conversations with your audience in terms of the relative contribution of each risk element. That's pretty interesting. Over a five-year horizon, credit risk is a relatively small contribution. Equity risk is pretty substantial, as is interest rate.

This is just the distribution of the absolute values that contribute to the 17.9 that you saw on the previous page. You can't ignore the skewedness of the distribution, and if you think of a previous page, you don't see the negative 20.4 there. So you need to find a way to communicate with management and show them the whole distribution.

I want to spend a minute, though, talking about the results over different horizons. Again, we're doing the same measurement over a one-year, five-year and 10-year horizon. I have a couple of observations. First of all, credit risk is about 10 percent of the total over one year, and it's barely measurable over 10 years, which is what you would expect it to be. I've often thought that a strategy around credit risk is somehow to protect yourself against the big hit over the one-year period, but somehow to leverage the time diversification you get from that exposure. Interest rate risk is relatively small. Remember, we're doing this math in a statutory context not a mark-to-market context, so interest rate exposures don't show through in a one-year horizon. Of course, the equity exposures do. But then as you progress through time, interest rate exposure becomes a more meaningful contributor to the total. If you were doing sort of an embedded value basis, that would look a little bit more like the 10-year number in terms of the relative relationships.

Of course, it's the size of business. With some of the assumptions, you need to be careful in putting all of this together. But in terms of helping management understand relative contribution to risk and understanding how the risks are not particularly correlated, in fact, there's a lot of diversification on the balance sheets. If you're a VA company, then this isn't a particularly useful exercise. But if you have some diversification across the balance sheet, it's a very good and useful way to help management understand. It's just that you need to spend time and effort in terms of building the infrastructure. There's some modeling that needs to be accomplished in order to get all these stochastic processes. Now there are tricks and methods. Leveraging on the fact that they are independent, there might be tricks around it to get to some of the numbers, the costs. You can treat some of these risks as totally uncorrelated with each other.

So what are the challenges? It seems to me that everybody has a day job, so the big challenge is getting management to support it, to put the resources behind the effort, because it takes time and effort to put something like this in place. Methodology is important—thinking through how you'll do some of the different calculations and then making sure that you're consistent period to period so that you don't have noise coming from assumption changes, modeling techniques or methodology coming through the measurement. Leadership is important. Typically when these things are successful somebody in the organization has made this his lifelong dream. Then, investing in the modeling infrastructure and taking the time and effort to build that infrastructure so that it can do the calculations that you need it to do is a challenge.

The key message is that integrated risk management is something that will be a big part of our lives over the next several years as we all struggle to implement it, put it together and make it useful and possibly even turn it into a competitive advantage. At the end of the day, it's the actuaries in the organizations that will get it done. Providing management with the information that they need will help it deal with external constituencies and make decisions around risk.

**MR. O'CONNOR:** I'll have a couple of comments. The support from senior management is very important because a lot of these things—perhaps all of these things—will not be put in place unless there is some strong support from the management of the company. I think Frank's comments about competitive advantage reflect one thing that has already emerged on the VA side. If you listen to analysts' calls, they tend to point out one or two companies in the industry that are doing a very good job in this area, risk management as well as ALM. I think it's just a matter of time before there are a number of companies on the fixed side that distinguish themselves and become known throughout the industry by the analysts, at least, as being at the head of the pack, if you will. I think there will be more and more pressure coming from the rating agencies and the stock analysts for companies to wrap up their risk management and their ALM capabilities.

**MR. PAUL J. HEFFERNAN:** Tony, I have a question for you. You put up a chart that showed that one of the industries that was most developed in using this was the energy sector. Do you have any insight as to why they are further along? Is there anything we can learn from them?

**MR. DARDIS:** It's an interesting question. I must admit the energy sector is not my specialty area. That chart was specifically with reference to the emergence of the CRO. Certainly in terms of managing risks, the energy sector has looked toward establishing a CRO position ahead of many other industries, now the reason why that is, I can't tell you. That's just a statistic that's evident.

**FROM THE FLOOR:** I had a question dealing with diversification. When corporations have significant property and casualty (P&C) operations as well as life operations, are there any special concepts in tying those two areas together, or is it really just a view of having separate lines of business? Is there any specific difference in dealing with that kind of a thing? Then a second question I had is, in terms of credit risk, are companies pulling together sort of a comprehensive view of credit risk in terms of looking at their vendors, for instance, and the type of investments they have in their securities portfolio, as well as reinsurance? In other words, how comprehensive are companies looking at that credit risk?

**MR. SABATINI:** On the diversification side—and this is more conjecture based on having spent some time with companies that have both P&C and life operations—I think one of the hardest problems is to get the two organizations to think in terms of the same metric. That's one of the hardest things to do, but from a conceptual point of view, there's a lot of diversification that should carry over if you tried to look at life and P&C combined. The problem I've seen is that P&C actuaries don't think and measure things the way we do. It's a matter of getting the two parties together and developing a common metric so that you can relate \$1 of personal lines exposure to \$1 of interest rate risk exposure on the balance sheet of the life company. To me, that's the biggest challenge. I don't think anybody has really addressed that. Does that answer the question?

**FROM THE FLOOR:** On the P&C side, they've been looking at ruin theory and statistical analysis for a long time, so it seems like the integrated risk concept should be second nature.

**MR. SABATINI:** My experience is that P&C companies, when they've looked at this, have tended to do so on an economic basis, which is not what the life side of the business would naturally gravitate to. Our measurement tends to focus more on an accounting basis than on an economic basis. At the end of the day, it's still getting the common metric so that you can do the measurement and overcoming just some of the language differences. I might as well be in Germany sometimes when I spend time with P&C folks.

**MR. DARDIS:** I think conceptually the same principle should be applied if you're looking at lines of business within a life company versus looking at PC and life separately. I've seen an exercise done for a company that involved not just life and PC, but banking as well. There are clearly some pretty major practical issues involved in trying to establish a consistent approach instead of assumptions across three quite distinct entities like that. But in principle, it should be capable of being done.

The question on the credit risk, can I touch on that one? I think that one of the biggest issues currently facing us actually is the assessment of credit risk within the life insurance industry. I think there's quite a lot of work that still needs to be done in that area. I think it's an area in which we could actually learn a lot from the banking industry. I know of one or two working groups that are doing some work in that area and looking at credit risk exposures and referencing back to what's done in the banking industry.

**MR. SABATINI:** I think the industry and generally any financial services industry participant have gotten pretty good at measuring credit risk on certain asset classes. There are a lot of tools out there that people use to measure credit risk exposure. So, for publicly traded bonds, private placements, a lot of mortgage-backed securities that aren't government-backed, people do a pretty good job. It's extending those concepts to other asset classes, as well as to reinsurance covers and vendors—although I had never thought of vendors, quite honestly, but certainly reinsurance exposures—and building that into the quantification. I've seen some companies do it, but it's not widespread. A lot of times you just don't have the data to support some of the measurement and sometimes you do.

**MR. O'CONNOR:** Let me add something on the reinsurance side. That is one area in which I think some companies do have a fair amount of exposure. I know at least one company that does some pretty extensive stochastic modeling of the credit risk exposure, in terms of coming up with their economic capital. One of the problems with reinsurance is the concentration of risk that the industry has. There are not that many reinsurers. There are fewer today than there were 10 or 20 years ago, and some companies have a lot of money in terms of reserves being reinsured. So,

at least one large multinational company is taking a stochastic modeling approach and coming up with its own economic capital. I forget the exact increase in the capital, but just using the NAIC Class One and so on designations, you'd come up with a capital of one unit. I think their economic capital for their reinsurance exposure was several times that amount because of the lack of diversification of the reinsurance credit.

**FROM THE FLOOR:** I've done this type of work many times over the years. I think I've been humbled by it. It seems we always get it wrong, and we'll always get it wrong. It's very difficult, probably impossible, to get the tails of the distribution anywhere close to right. Who would have known that interest rates would go to 20 percent or come back down to 4 or 5 percent? I guess the point of all that is to me it seems the importance of risk management is that—risk management as opposed to risk measurement. What you've spoken to here is risk measurement and trying to come up with distributions and look at the tails and compare this risk to that risk.

It seems to me one can do that endlessly and maybe miss the point. To me it's more important to understand variety of risks and get some reasonable prioritization and really understand that this particular risk is really big, and this one is not so big, and this one is sort of small. Your perspective on that was interesting, but could you speak a little bit about risk management as to, you've done the measurement, you've done some prioritization. You've spoken about risk management as a competitive advantage, but could you speak a little bit more as to the management part of it?

**MR. SABATINI:** I'd be happy to. I really appreciate the question because I actually probably should have spent a little more time on that. One of the messages that I probably wasn't clear in conveying is that it's awfully hard to manage what you can't measure. That's the first step, and that sort of was the message today. My experience is that for organizations that do good risk management, it's not about the measurement; it's about the management. But the measurement is important. There are many organizations with different levels of sophistication and emphasis in risk management across the industry. The ones that do it well really focus on the management part of it, but they need the measurement to guide them.

Those organizations aren't necessarily so focused on getting the positions right. They may be doing scenario analysis on top of stuff like this to support the management process. But at the end of the day, it's leading to actions. There are a lot of companies that have taken much more in the way of action in terms of risk mitigation, so there are companies out there today that are sitting on asset positions that have them protected against the rise in interest rates, and there are companies that aren't. Well obviously, the companies have made a decision that that's an exposure they want protection against, and they've taken appropriate action. But the management part is really behavioral and cultural, which wasn't really one of the topics today. Tony covered it. But you need the measurement to

support that.

I do agree with you. You could measure it to death, and in my mind one of the hardest things to do is to understand how much of one risk exposure you have relative to another. That's the message I was trying to give today. I don't know if that answered the question.

**MR. DARDIS:** It is a good question. I see risk measurements as being part of and integral to the risk management process. Every strategy that the company does in terms of investment policy, asset allocation, reinsurance strategy, etc., are all part of the risk management strategy. Certainly we could have covered specific risk management strategies, such as usage of derivatives, but as I say, I think it is important to recognize the interrelationship between risk measurement and risk management, which we have focused on today.

**MR. SABATINI:** One of the biggest challenges today is just creating that kind of culture and getting management support to do that. Risk management tends to be exceptional in many companies, but not in the corporate sort of way, which is why you see the emergence of the CRO and corporate risk management functions in the industry. At least people are paying more attention to it, and hopefully people will take more risk management actions. Some people are doing a pretty good job on it.

**MR. O'CONNOR:** I think another step that actuaries can take to help, whether they're in risk management or an ALM area, is to offer up alternatives. For example, if you do have significant interest rate exposure, test some alternative asset strategies. Management can't decide unless you give them alternatives. They have to have a certain risk and return framework that they apply across the company, but if a company knows that it has interest rate risk and that's all they know, there's nothing for them to decide. So I think it's up to the risk management people or the ALM people to offer up alternatives. "Here's the risk profile where we are today. If we reallocate some of the assets to different classes or do some hedging, here's how the profile changes." Then it's up to management to choose. But they can't manage unless they're given alternatives.

**FROM THE FLOOR:** It appears that even in smaller and medium-sized companies, it will be very difficult to get management to buy into this. The easiest way is to go ahead and present the results, but developing the results is difficult without management buy-in. Is there any movement toward rating agencies or regulators requesting this information? That would definitely get the management to buy into it. I was just wondering whether you're aware of any action in that area.

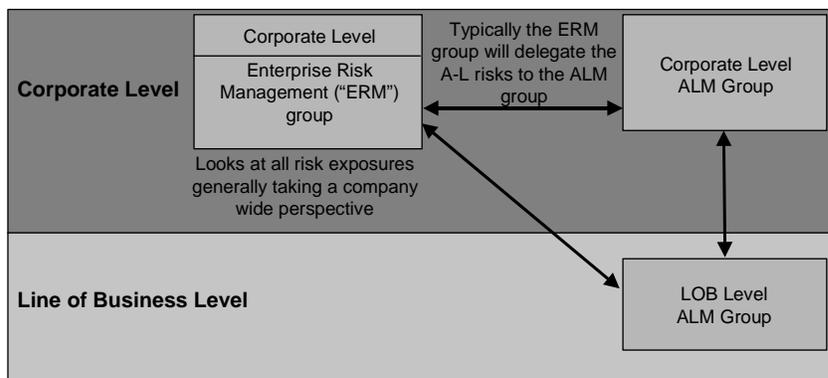
**MR. O'CONNOR:** I'll hop in on that one. Standard & Poor's (S&P) is getting quite public about the types of questions that they will be asking companies about their risk management and their asset liability management. I think also that stock analysts, as they have gotten more educated in terms of risk management, are

asking a lot better questions today than they were five years ago. So there's at least one rating agency that is being more sophisticated in the types of questions it's asking, and there's at least one other rating agency that is looking at revising its whole risk-based capital (RBC) approach so that it can better distinguish among companies in terms of their risk management and ALM capabilities. They want to distinguish the risk profile for a specific company rather than using industry-wide factors, for example, to see through your risk.

**MR. DARDIS:** The smaller company issue comes up quite a lot. I think you wouldn't expect the smaller company to have to implement a lot of the ideas that we've talked about today. Having said that, the establishment of an integrated risk management framework is still something that smaller companies should be doing. And in fact, because it's a smaller company, arguably it should be easier. But setting up a sophisticated risk management committee or asset liability committee may not be appropriate for a smaller to medium-sized company. But as I say, I think in terms of integrated risk management there are certainly things that smaller companies can be doing.

Chart 1

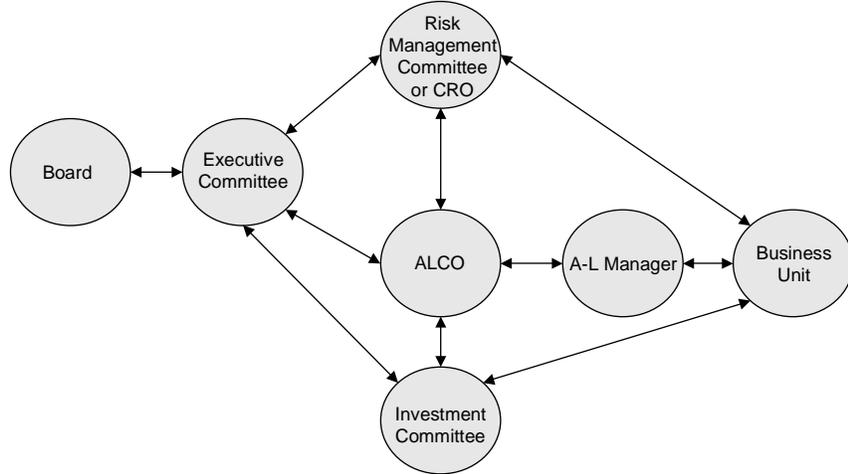
 Good corporate governance in the risk management area begins by establishing the distinction between risks that impact at the line of business level and risks that impact at the corporate level



The ALM group aims to get company to desired risk-return profile. Thus a "value added" activity.

Chart 2

Once the relationship between risks have been recognized, appropriate forums can be established for effective integration and communications



Note: The Risk Management Committee is regarded as a separate unit, with different roles and responsibilities to the ALCO. In some situations, it may be appropriate for the ALCO to report to the Risk Management Committee, with the latter then reporting to the ExCo. In this schematic, the ALCO and Risk Management Committee both report to the ExCo, with good communications between the two.

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Chart 3

A "best practice" ERM framework includes the management of financial and operational risks

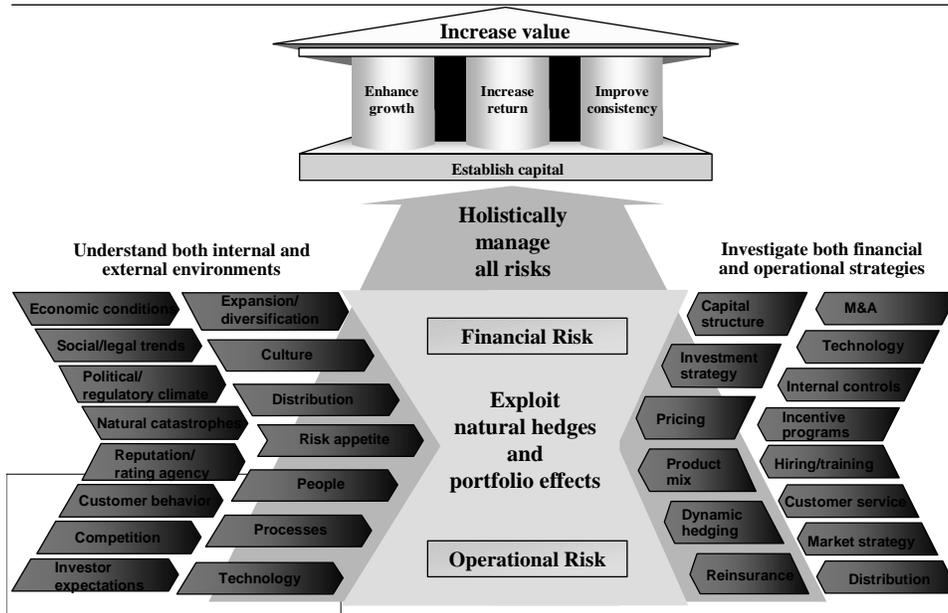


Chart 4

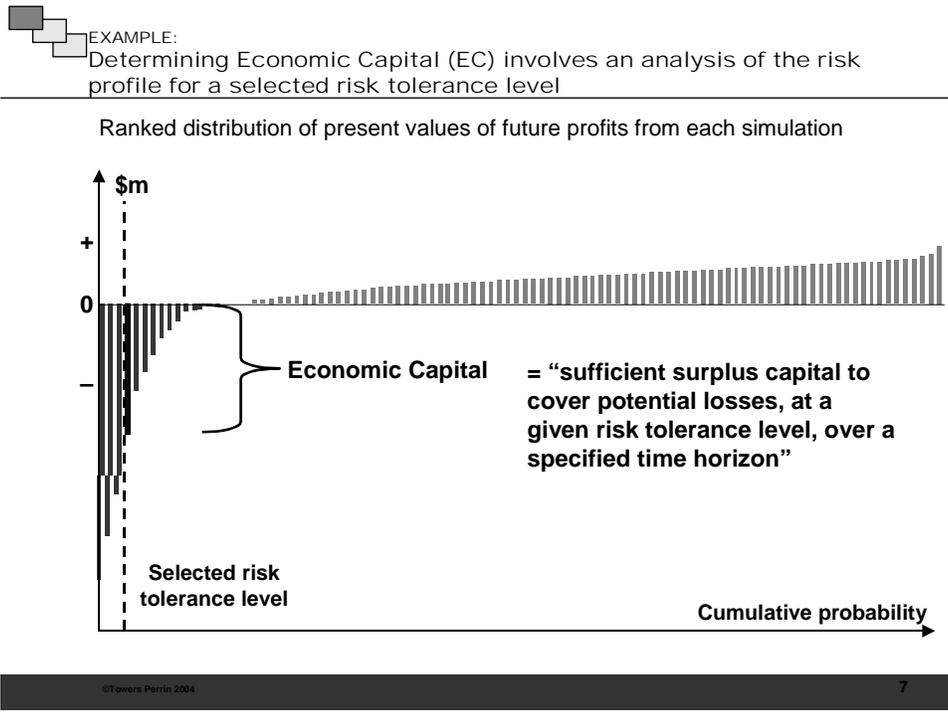


Chart 5

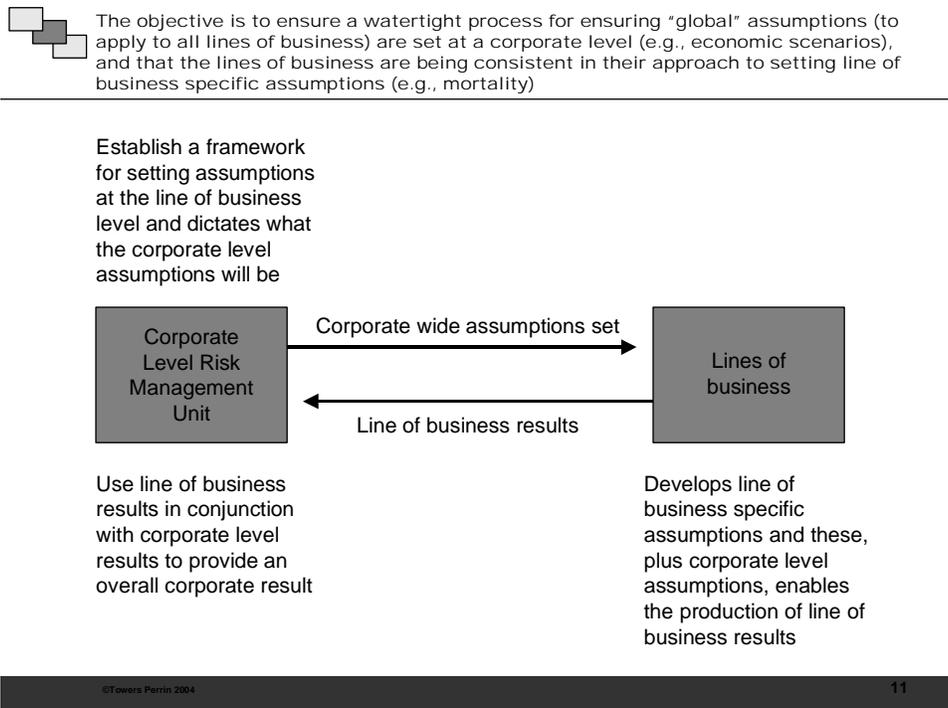


Chart 6

Each line of business needs to combine "global" level assumptions and line of business level assumptions and ensure they are set so as to properly capture the correlation between risks

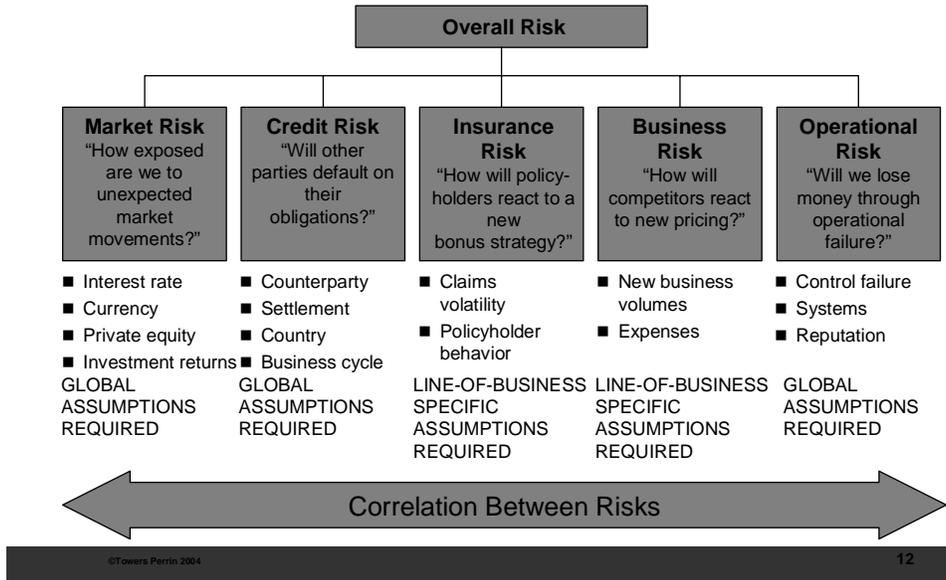


Chart 7

Different risks are typically incorporated in one of three ways

Market	Credit	Insurance	Business	Operational
<ul style="list-style-type: none"> <li>Investment returns</li> </ul>	<ul style="list-style-type: none"> <li>Reinsurer default</li> </ul>	<ul style="list-style-type: none"> <li>Claims volatility</li> </ul>	<ul style="list-style-type: none"> <li>New business volumes</li> </ul>	<ul style="list-style-type: none"> <li>Human resources</li> </ul>
<ul style="list-style-type: none"> <li>Inflation</li> </ul>	<ul style="list-style-type: none"> <li>Counterparty risk (derivatives)</li> </ul>	<ul style="list-style-type: none"> <li>Policyholder behavior</li> </ul>	<ul style="list-style-type: none"> <li>Expenses</li> </ul>	<ul style="list-style-type: none"> <li>IT</li> </ul>
<ul style="list-style-type: none"> <li>Currency</li> </ul>	<ul style="list-style-type: none"> <li>Credit spreads</li> </ul>		<ul style="list-style-type: none"> <li>Pricing</li> </ul>	

- Risks and their relationships developed in economic scenario generator
- Formulaic relationships, linked to scenario generator output
- Parameter distributions developed outside scenario generator

**Chart 8**



The Society of Actuaries 2001 risk reports survey ranks the materiality of operational risks as highly as financial risks (results shown below are for all participant companies, i.e., Life, P/C and Multi-line)

- On a rating scale of 1 – 5, where 5 is high

<b>Risk Category</b>	<b>Rating</b>
Liability Reserve/Pricing adequacy	3.09
Liability claims costs	3.05
<b>Regulatory intervention</b>	<b>2.93</b>
Liability catastrophe risk	2.67
<b>Business volume risk</b>	<b>2.65</b>
Asset market risk	2.59
<b>Key personnel</b>	<b>2.58</b>
<b>Taxation</b>	<b>2.52</b>