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Session 54PD Enterprise Risk Management

Track: Financial Reporting

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Recorder: FRANCIS P. SABATINI

Summary: Actuaries are trained to measure and manage risks, for example, mortality, morbidity, interest rate, and asset default risks. However, the range of risks to which companies are exposed is wider than is sometimes considered. This complex array of risks needs to be managed holistically in concert and not in isolation. The actuary is increasingly called upon to assist in this process and needs a broader perspective and more powerful toolkit.

Mr. Francis P. Sabatini: We have three distinguished speakers. Max Rudolph is with Mutual of Omaha and is responsible for financial risk management. Russ Osborn is responsible for asset/liability modeling (ALM) risk management, corporate risk modeling, and investment policy analysis for the lines at Nationwide. I'm a partner with Ernst & Young, and I'm responsible for our risk and value optimization practice.

Mr. Max J. Rudolph: Enterprise risk management is an interesting topic, especially for actuaries. There are so many different ways you can go with it. I'm presenting my opinions on the ways that a corporate actuarial unit could fit within a corporate structure. It's not the only way to do it. I don't know if it's even the best way to do it, but it's a way that my company and a lot of other companies are starting to move toward. I'm looking to get some issues out on the table.

How many of your companies have actually adopted the strategic business unit (SBU) structure, where the pricing and valuation actuaries are all in the business unit? How many companies have the other structure, where pretty much there's a corporate functional actuarial area that does pricing for the different product lines, does valuation for the different product lines, and things like that? For this audience, those companies with each type of structure are about the same.

There's a movement towards the SBU structure. For the companies that have the SBU structure, how many of you still have a separate corporate actuarial unit? Okay, actually I'm seeing more hands now than I did before.

Another topic that's near and dear to my heart is chief risk officer. I think the world is moving in that direction. I think the Europeans have moved faster than we have. How many companies have a chief risk officer, not necessarily with that title, but a person who is acting as a chief risk officer, looking across all the different product lines? About 20% of the companies in attendance; that's pretty good. That's actually higher than some of the surveys have shown. Of those with a chief risk officer, how many have an actuary in that position? It looks like for most of the companies attending, if they have a chief risk officer, that person is an actuary. How many have a non-actuary in that position? There are just a couple.

Actuarial oversight is another topic that I'm interested in, because at our company, we've been challenged through the corporate actuaries to be doing actuarial oversight of assumptions and methodologies and things like that. Our corporate actuarial unit actually only has 14 people. We have individual, group, and a wide variety of lines within that unit. Now we're trying to figure out how to do it.

I'm going to discuss four different aspects of risk management: (1) about the role of a corporate actuary unit; (2) some of the deliverables that an actuary unit might provide; (3) and some of the challenges that I'm seeing. This certainly isn't a complete list, as I'm sure that the list would be different for each company. Then (4) I'll list some tools of risk management.

The corporate actuarial unit, in theory, brings an independent view to the company. You might have a product actuary excited about this new bell and whistle, and the corporate actuary unit can ask, "Did you remember to price for this? That seems like an option that you're giving away, that you're not pricing for." It brings an independent view, and just gives an outside view without having to go outside the firm to do it. It can encourage the disciplined risk management, since this is generally the area that is going to be outside of the silos and trying to go across silos and look at diversification, by having different risks. We can encourage a continuous process that's well documented. Again, across the silos, we'll recognize the internal hedges.

The corporate actuary, at least in my opinion, has the ability to look a lot further out than some of the pricing people or the business units are able to do. They should be able to step back and ask, "Where do we want to be five, 10, 20 years from now?" when the business units are more focused on five years and less, from now. Then we can provide a resource to the CEO and to the product managers for the business units, to help them develop and implement ideas, bringing back ideas from networking with other companies and with consultants and a variety of other people. Meetings like this are really good for that, and I spend a lot of time in the exhibit halls just talking to people about what they are doing, and telling them what we are doing, and we leapfrog new ideas off of each other. I'm always willing to borrow ideas.

In terms of financial risk management, what you're looking to do is eliminate, transfer, or actively manage the risks that you've taken on. The key is to make that a conscious decision. A lot of times, we get into this, "That's the way it's always been done." The corporate actuarial unit, thinking in terms of the big picture, can

really focus on some things that the product lines don't have the time or interest to do. They think, "We've always reinsured this product the same way; why wouldn't we do that now?" Maybe we say, "But now we've added a whole bunch of different product lines since you started reinsuring that, maybe this risk is low enough to the firm that if you still want to reinsure it, maybe we should reinsure it internally."

You want to make a conscious decision of how you're going to deal with your risks. This is obvious to me, but I think it is worth saying that, if you're managing your risks better than your competitors, that's a competitive advantage. You could lose less money than somebody else, if you recognize that you've taken this huge risk, and you've hedged it. Somebody else can take the same huge risk, doesn't recognize that it's a huge risk, and doesn't hedge it. Financial risk management would have a close tie to projects that my company calls actuarial oversight and capital management. The actuarial oversight is the assumptions and methodology.

The capital management projects include things like what you use for your internal target surplus, your internal capital, doing internal reinsurance for mortality, morbidity defaults, that type of a thing. The projects should really be focusing more on corporate-wide strategies, and corporate-line management, even getting into the expense side, to some degree. One thing that you want to eliminate, or at least fight against, is the perception that your job as the risk manager is the person who says no, because nobody wants to talk to the person who says no. They're not going to talk to you about their new ideas. You're just not going to get the face time with them. But if you go in with ideas on, "Well, can you modify this," or "Here's how I would price for it," or something like that adds value to the firm and to the business unit that you're talking to as well.

Accountability, just briefly, leads into some of the things that Russ is going to talk about in terms of who's accountable for a lot of this risk management. Do you have a single person or do you have a risk management committee? In terms of deliverables, what are we really responsible for as a corporate actuarial unit? First and foremost we're supposed to be prioritizing the risks, and then going and attacking them, and trying to deal with them. Then creating a structure to maximize economic value and coming up with a process that business units should use to price a product, to calculate their embedded value.

Recently, at our company, we were collecting data, such as expected ROE, and we found out, just by chance, that the way one area defined ROE was a little different than the way another area defined ROE. None of them were really wrong. I think that's something that we'll work with in the next year or so, trying to get that all standardized to where everybody's doing the same thing.

One of our accountants always talks about the banker. You have to go to the banker to get your capital and your money and everything. That banker has to have a consistent look at each one of the business units. If you're doing things a little bit different for each one, it's hard to do that. Again, I think you've got to walk before you run, so I think you focus on the financial risks first, and then come back to the operational risks. Let internal audit, or whoever else is working on that, run with those. There are plenty of risks to deal with on the financial side, without trying to

bite off way too much more than we can chew. We can then improve our decision-making tools. That's the consistency, getting the process set up.

The other deliverable that we have is to lead cross-functional teams. For example, if you have an acquisition team, maybe the corporate actuarial unit would take a lead in that. If you're buying a company, or looking at buying a company that goes across several business units, you might want to do that. For example, when Metropolitan, was looking to do financial services, they put the head of their corporate actuarial unit in charge of that team.

One of the tools that I think is really useful (it's something that every company should have) is something like your old management discussion and analysis. As we get a little further away, as a corporate actuarial unit, from the day-to-day running of the operation, it's important that there be a document that aids the communication between the areas. It's not useful unless it's updated regularly. It's not a once-every-five-year thing. I think you've got to include your strategies in there, to really get into your drivers of your product-line results, whether it be bottom line or top line, what is really causing you to have more sales or less sales or higher expenses or lower expenses, whatever. You really need to get into detailing the risks.

I would say, again, walk before you run. Do some stress testing. Consider your variable annuity (VA); What is the worst risk for that line? If you have a major medical block, what are the risks that you have there? When you get to that banker stage, the banker's not going to understand a lot of that stuff, so you have to provide it to them with not only the risks but also the challenges and the opportunities. Don't just explain the short term, what you're going to do in the next quarter, but show him where you see this business unit in 5–10 years from now. I think that can really add a lot of value.

Anybody who has been part of a corporate actuarial team in this structure, knows the first challenge is being considered as an outsider to the product line, when you're not working with it day to day. We're going out and really focusing on trying to bring some of these tools back, and the more open communication lines are between those areas, the better. A lot of times, we can take ideas from one business unit to another business unit as well, and maybe we find a tool that will work for both, but we would tell both areas at the same time. Sometimes one product line finds a tool, and they share it with us, and then we make sure that it gets shared with everybody.

Single-scenario pricing is an industry-wide issue. It's tough to move past single-scenario pricing, but we need to iterate, doing stress testing, and then eventually doing more stochastics, valuing the options granted. If you're the person saying, "Boy, we'd better value those options," you're also the one saying, "I think the value that's been calculated so far is too high." That doesn't make you the most popular person in the boardroom. But I think it's important to do, and we have to work through ways to do that. You may need to expand staff.

I wrote an article for *Financial Reporter* in the mid-90s, talking about leveraging off of existing models and your cash-flow-testing model. I was amazed, when I read it last week, that I really wouldn't change that much. I'd add more stochastics on the mortality and morbidity. In terms of the other things, I'm a real proponent of trying to do as many things as you can with the same model. The models that are out there now run a lot faster. We were doing cash-flow testing in 1990 and you could only model four liabilities because it would run for two hours just to do those four. Today, you could really run across a lot of machines, and there are a lot of software packages that allow you to do stochastics across a lot of different variables, which is really useful.

At our company we're going to try to implement the single-scenario embedded value this year, but we will also be calculating options-adjusted value of distributable earnings (OAVDE) in our area, so that we can start getting a feel for that. At some point, I hope we can do enough education with people, because it takes awhile to get people to buy into OAVDE.

Currently, we're talking about using just stochastic interest rates on that. The next step beyond that is unified valuation system. How far away is it? It depends on who you talk to. I think it's a lot closer than it was two years ago, mainly thanks to Luke Girard. He did a paper and a presentation a year-and-a-half ago that really took the two competing camps that were spending a lot of time saying, "Do it my way, do it my way." He said, "Allow one price, those two ways are the same if you use consistent assumptions, so let's move beyond that and start doing it to actually get some useful results.

Duration studies

That's something that we currently do, it's all driven off of cash flows. I think it adds a lot of value, not necessarily for the duration numbers, although those are useful. When looking at our value of a product line, we actually build it at the product line level and then roll it up to the company or the business unit level. As you trend it over time, you can see which lines are adding value, which lines are dropping their value. It can be a good communication too.

There are some things to struggle with for GAAP earnings at risk, primarily unlocking assumptions into the future, if you're going to try to go out more than a year or two. When projecting risk-based capital (RBC) for rating agency tests, I specifically listed liquidity even though that is a rating agency test separately, because the rating agencies look at that as a balance sheet. I know when the rating agencies come to our company, I also show them a couple of stress tests, and our expected cash flow on a level scenario and a pop-up and a pop-down. This can show that we're in pretty good shape if we are strictly looking at interest rate risk.

All roads lead to a unified valuation system (UVS). I think in the future we can use UVS to do capital, to do our total required assets, and once we get comfortable with that, we'd be able to use it for GAAP, essentially picking out the best estimate, 50th median scenarios.

When I give a talk to nonactuaries, which I don't do a lot, I try to start off with a comment about how we're trying to anticipate the risks of tomorrow before they become the risks of today. The shortened version of that is, keep your company's name off the front page of the newspaper.

Mr. Russell A. Osborn: I'm going to talk about real applications of what we call corporate risk management, which is the first step toward enterprise risk management. In 2000, we developed the capability to do a complete stochastic model of the entire company at the corporate level, and I'm going to show you how we did that. The objectives here are mainly to talk about the expanding scope of the modern actuary and about actual risk management practices at Nationwide, how we're going to begin to use risk management for adding value.

Frank and Max gave a similar presentation to this one at another meeting earlier this year. They came away with the impression that there are a lot of product development actuaries coming to sessions like this and thinking, "Gee, that's neat," but they go home and they don't think that it really applies to them, or that that's for the future and not for now. I think we're saying that it is now, and it is for any actuary who wants to stay on top of the skills needed for this industry. What we're talking about with corporate risk modeling (CRM) is being able to look at the entire holistic picture of your company, across stochastic sets of scenarios of all the possible risk variables that you're interested in.

Nationwide Financial has recently come out with written documents that describe their decision-making framework, and the process for ALM-type risk management and decision making. At the top level of decision making is our executive risk committee, which includes key senior executives, the CFO, the chief actuary, the chief product manager, and the head of investments. Something that's new with this, they've appointed an operations committee that will report to the executive risk committee, and will handle all the auditing and technical examination of different proposals, and weed them out before they actually get to the executive risk committee. Before 2000, we had tried taking proposals directly to the risk committee, and what ended up happening was that those presentations were generally too technical, or raised too many issues that required going back to the drawing board and iterating back and forth. We're hoping that by having this ALM risk evaluation group, which my boss heads, we'll be able to make better presentations and focus in with a common framework with presentations that have already been screened and that management can understand, in the language they speak.

For the actual implementation of the analysis, we're trying to encourage teamwork throughout the organization, including our ALM actuarial group and the corporate actuarial group. There are two corporate areas at Nationwide. One tends to focus on building the ALM tools, and focusing on strategic things like product development and investment policy setting. The other area of corporate actuarial does the more traditional corporate role of cash-flow analysis and value-added analysis, and surplus projections. We're also involving the line actuaries. We have ALM staff as well over in our investment department.

In order to get everybody working toward the same goal, we've established what we call base-model process. I'm going to talk a lot about process. I'm very big on it and I think it's one of the keys to actually getting ALM up and running at your company. What we're trying to do is build models that are in a central repository, that any of the potential users of the models, throughout the company, for any application, can go to that library and pull out the code and data that's needed for the most recent valuation date. We currently do that every quarter. Everybody has defined responsibilities for getting data there regularly. In those models, we tried to define common protocols for the base models that would provide the most efficient starting point for any applications. What you would do is take the data for the base model, and then modify a few things to make it work for your own application.

We also have developed our own economic scenario generator that we built outside of the existing software ALM applications. As part of the recent management decision about ALM process, they've asked that each of the product managers present a risk assessment for their lines, at least annually, and to be able to do that for not only their existing block of business, but projections of future business. They also should be able to look at it with and without reinsurance and capital market hedging. For 2000, our goal was to be able to do all this for a statutory distributable earnings framework. Our goal for 2001 is to expand that to include stochastic GAAP analysis, so that we can be able to do projections of GAAP earnings under different economic scenarios.

The key thing to think about in building this is communication. I've found that this is key in trying to organize something this large, where we literally have 10 departments that are involved in trying to set up the corporate risk model. You need to make sure that you're communicating everything you learned to all the right people, getting all the right people at the right meetings, and building the right expectations about what the end product is and how every player fits into that.

The other key consideration is having a framework. I'm sure we're not alone in this. Until our senior management came out with a framework memo that detailed, in black and white, what is the basis for our decision making, we spent a lot of the time in our meetings arguing with other departments about what the goal actually was. That especially happened between actuarial and investments. I'm sure that kind of spending is going around in a lot of companies, and we're lucky that we got our management to step forward and say that. I would encourage you all, if you don't have such a statement yet, to encourage your management to do that.

The other thing is buy-in to all the key players, somewhere in objective setting or in compensation. This has to matter to the product actuaries and investment people, who need to be at the table to build these models and make them credible. The overriding goal for the product actuaries is to sign off on the models that are sent to the base model server. To say that they're willing to use these models for making line decisions, and they're also willing to stand in front of senior management and say that the model is worthy of making corporate-level decisions.

In our company, we've got the data feeding in from different areas. Generally, we just get the standard data feed from our investment department that feeds into our software. Then we have three-pronged teams set up, a person from corporate actuarial, a person from the actuarial department, and then a key person from the line of business. They all work together to put the model settings and the liability in force, and then the liability assumptions. We tried to make sure they keep the in force separate from the assumptions, so that when every new quarter rolls around and we want to update our models, all we need to do is update the in force. If the assumptions are set up robust enough to just update the in force, then we don't need to go back and do a lot of manual work or weighted averaging on a calendar basis to try to get our assumptions set again.

We decided, for the base model purpose, to make the in-force amounts, for both existing and new business, as granular as any model that's going to be used for an application. Then any particular application, like anything where we are going to run a lot of scenarios like ALM and corporate risk modeling, we would want to run maybe a crunched, less-granular model, so that we can get our run times down and run a lot more scenarios. We thought through what the characteristics of the base model would be so that we would be sure to cross most applications. For example, if we wanted to do a GAAP plan analysis, almost everything is ready to go except in the base model we have our risk surplus, so we just pull that out, and then we turn on GAAP, but everything else is ready to go. For ALM modeling, all the settings are right, we have the assumptions we want, and all we need to do is crunch the liabilities.

We also have regular model review sessions, where we get product actuaries, the people who are building these models, the corporate actuary, and the ALM actuary together and we do a peer review analysis. We have utilities that show graphs of results from the database onscreen, and we do drill-downs. We look at actual financials and try to compare the results of the model to the actual financials for a real scenario. We run several test stress scenarios, and we make sure that the financials that we're seeing actually make intuitive sense to the person who's expert in the line. We've found that to be very helpful. It has increased understanding a lot, and it has bought credibility in this corporate risk modeling within the lines themselves. They gained a lot more comfort with the models from going through this process.

Max said this earlier, and I totally agree that the role of risk management should in no way be constrained to managing the tail of your risk and saying no to bad projects. There's a lot of potential for using these tools for adding value. One of the most important things is to give your senior management a holistic picture of what the risk profile is. We have a new CEO at Nationwide who came from the world of banking and he's used to seeing daily updates to his risk profiles. Now, we have some educating to do to let him know the complications that arise on insurance liabilities, but I think that it's reasonable for senior management to want to see periodic risk updates for an entire company for an insurance enterprise. We plan to give it to him. It won't be daily, I can assure you, but it will be regularly, at least quarterly, and with the ability to turn around within a week if he wants it on any other particular date.

It's also a tool for making strategic decisions. It's not just an after-the-fact tool to find out what risk you should hedge, but it can be used up-front for making important decisions in product development and in crediting strategies and in reinsurance strategies. Also, if you have the ability to look at the holistic picture of your company, you're going to see the value of the synergies you're getting from line to line. Everyone intuitively believes that, since Line A and Line B are not perfectly correlated in their risk, that they're going to tend to offset each other. That ought to allow you to gain from that at the corporate level, but until you have this analysis built for the whole company, you're not going to be able to know exactly what that is. Once you know, it can help you make important capital allocation decisions about what product lines you're going to be in and what business mix you want. If the tail of your risk is under control, it ought to reduce the need for going out to reinsurance markets or to the hedged derivative markets to lay off that risk. You're going to pay risk premium to do that, and if you can keep that risk premium in your company, that's adding a lot to bottom-line. That's very much of strategic value.

The other thing is, once you can see the risk profile for your entire company, you can now begin a dialogue with senior management about the actual goals of the company, what they want their risk profile to look like. You can iterate and do corporate repositioning without affecting lines of business that will align the corporate risk profile with the goals of management and investors.

Also, once these processes are in place, you can quickly turn around what-if questions. I think this is going to be of value, because we often get questions from either the president or the CFO. We can even answer a question that some important shareholder has. For example, what if 40% of your business was in this other product that we only have a little of? Questions like that could be illustrated. The other main benefit is, that if you have these tools available, with a regular process where you can crank out a corporate risk model and all the statistics, you have sound management. We plan to take this to the rating agencies, and say, "Look, this is our risk profile, and we're going to be able to provide this regularly, and we can answer any questions that you have." We expect that it should reduce the capital needs that are conservatively set, using simplistic formulas.

Our ALM actuaries prefer to look at results. We are hoping that a year from now we will be able to tell you what our senior management responded to and what they didn't. But right now, I think they're used to looking at S curves. You would do a projection of distributable earnings, under as many scenarios as you want, and then you discount them all back. This is present value of distributable earnings. You then sort them all, and you show them from worst to best. This method still has a lot of issues in it. It is not entirely up to speed with the sophistication of Wall Street pricing, because you do have to pick a discount rate to do these present values, and all of the fudging in this type of analysis is in your choice of discount rate. But I think it's a good place to start, because your management understands discounting at a certain rate, and they're already comfortable telling you, this is your return objective and we want to see results at that rate. We're running realistic scenarios.

In addition to present values of distributable earnings, we look at distributions of earnings by year, because the framework that our management espouses now for decision making is to optimize the distribution of present values of distributable earnings, while considering the volatility in earnings per share. In order to know everything we need to know about managing risk and whether we can go naked on certain risks, without going to the hedge markets or reinsurers, we need to determine how surplus performs over time, and whether it actually decreases under some scenarios, and how often. We need to determine distribution of surplus as well.

First graph an S-curve of present value of distributable earnings sorted from the worst scenario to the best. I think you're going to get a lot of bang out of this graph by showing it to management and saying, "We have a significant buffer here, on the tail, and we're probably taking about the right amount of risk, do you think that's right?" Get them comfortable with this type of graph, and start to talk about the implications.

For some lines under some scenarios, the tail might actually go negative. You might be inclined to look at those and conclude, "Well, maybe we ought to go out and find a way to hedge that tail." However, remember to keep it in perspective. It may be an insignificant line. It really sets your perspective on what's important, and you can pick out which of your lines are really driving results, and whether it is equity-sensitive, interest-sensitive, or credit-spread-sensitive lines. By the way, right now, we're running scenarios that include interest rates, inflation, and equity performance on the indexes.

We did a distribution of accumulated surplus scenario that shows, at the end of each future quarter, the median surplus amount across all scenarios. And then it shows the 90% confidence interval, fifth percentile, and then the 95th percentile. This was done, again, with existing business, no new business. But this is very useful, because it gives you some idea how much tolerance you have for capital usage and new business production. And, if you use this data in conjunction with your liquidity studies, you can present a very comprehensive case to the regulators, rating agencies, and your management about the soundness of your risk management.

Something we'll be able to give to our office of finance and the investor relations department immediately, is some of the key line items from earnings that they're interested in seeing projections on before they go to the interviews with the analysts every quarter. We'll be able to give them line items such as interest spread and risk fees on variable products. We don't have the GAAP reserve adjustments yet, but we'll have most of what they want and we can do what-ifs under some key deterministic scenarios and give them statistics under stochastic scenarios.

Now, they probably don't represent all that to their analysts, but it'll be under their belt, and that'll make them a lot more comfortable going to those meetings. The other thing is, we really want to get input from all the players that were involved in this management risk model and ask them, "What do you think are the key determinants of these results? Which assumptions are most sensitive in

determining the shape of that S curve?" Eventually, we want to have a standard set of sensitivities that we run. The problem is, right now, to get that S curve, we've got about an eight-day turnaround for the whole company. Once all the models are set up, the machine run time is eight days. We really have to pick and choose what we run now, but we also want to be running more scenarios.

Here are the key risk variables that you should be looking at. The most important ones obviously include interest, inflation, equity returns, and equity volatility. I think something that is going to become key very soon, and we're already starting to look at and we plan to have it by this time next year, is to have stochastic asset spreads, along with asset-quality transitions and asset defaults on a stochastic basis.

We've built our own foreign currency exchange model. It doesn't yet feed into our standard software, but we have it available for what-ifs on external applications. Eventually we hope to get our base software to include foreign interest rates models and the London Interbank Offered Rate (LIBOR) curve. Lately, I have found that most of the existing models and third-party add-ons, like the indexes for collateralized mortgage obligations (CMOs) and Andrew Davidson prepay models, are based off the Treasury curve. All of your spreads are stated as spreads over Treasuries.

Recently, we've seen this kind of anomaly in the Treasury market where the long end of the Treasury curve is undergoing an historical anomaly, and everything is not intuitive. You might look at the current Treasury yield curve and conclude that the current yield curve is inverted. But it's not really, if you are investing in corporate securities, the corporate curve is more normal-shaped. What we would like to be able to do is to base everything off the LIBOR curve. Practically speaking, what we're going to do is add LIBOR as one of our variables and feed it in, because most of our data that we're getting, like our Andrew Davidson prepay model, is calibrated to Treasuries. The spreads that we get in our asset models are all based off Treasuries. That's going to be a transition. It's something to think about.

Also, eventually we hope to have factors that could be used in building policyholder behavior formulas, where they would just draw factors from the economic scenario including stochastic mortality. Currently we only have one fund type, and that's S&P 500 Index. We've found that that's not very sufficient. We're able to apply like a Beta factor to that along with a bond fund model where you've already precomputed the returns on a bond fund under different scenarios, and then just feed that in like it's one of your economic variables. Maybe five years from now we'll be talking about adding some other stochastic variables as well. I do want to say that, even now, on certain lines of business, we've determined that there are risk variables for that line that are very important. They are important enough to be modeled, but not included in our economic scenario generator. One of those is lapses. We have at least two lines of business where we've determined that that's one of the key stochastic variables that we would want to model stochastically, and where there's really no good way to drive that from economic variables, because there are other considerations that drive the lapses. What we've done in that case is, within the liability model, we actually generate random numbers on the fly. We

then do what's called a convolution of those lapse scenarios against our set of economic scenarios. That means for every economic scenario, maybe there are 100, you'll run it 20 times, and each time you'll generate a different stream of random lapse variables. You've got 20 times 100, you're going to have to run 2,000 scenarios to do that.

One of our major challenges has been sample size. Currently that is probably the weakest link in our corporate risk modeling. We did a study where we took a simple liability product, I think it was an immediate annuity with a simple investment strategy, for new business issued, times zero, we ran 50,000 scenarios. As we travel across the X-axis, we plotted the present value of distributable earnings for scenario 1, 2, 3, and 4, all the way across. Then we took them and we grouped them into different scenario sets and computed the average present value of distributable earnings.

When we graphed it, each dot represented the average of 50 scenarios, and we had 1,000 dots on the graph. The answers are all over the place, fifty was definitely not adequate. Remember, this was for a simple line with only one risk variable. If we took the same sample set, and grouped them into sets of 100, it would still be inadequate. Take the same 50,000 and break them down into sets of 250, I think you're still not there. This is something you should be concerned about, and one of our priorities is to try to find ways to get run times down and to increase our hardware capabilities so that we can run more scenarios.

These are the things that I think that we're going to be looking at next to increase our capability. As I mentioned before, we want to be able to do the full GAAP capability. We want to be able to analyze results net of our reinsurance contracts, and to be able to do it gross and net of potential reinsurance contracts that we may be evaluating. We want to add more risk variables. Right now, our models don't do dynamic loans, and that's something that we want to be able to do. Our current model includes our two major companies, all of our life and annuity business. We also own a large fund management concern and then a couple other fee-based companies that we want to throw in their as well. Then we'll have the complete Nationwide Financial picture. I think everybody knows technology is changing, and we're going to need more of it, in both software and hardware.

With respect to assets, this has always been the major bottleneck in run times. We've looked at a lot of different ways to attack that. Right now we're using the standard software for doing most of our asset modeling, but for types that the software can't handle, we're building what are called asset tanks, where it's just a database, based off of the scenario file we're going to run. We send the scenario file to our investment department, and they send it back with all of the information we need for the projections for things like calls and swaps and equity link notes and other things that our current software can't handle.

We need to keep our eye on change of valuation laws. I'm curious about UVS, if we get UVS, how are we going to do projection? If we're going to project financials, we need to be able to do UVS at each node in the future. In this model, that means scenarios within scenarios.

Mr. Sabatini: I have a couple of themes that I want you to keep in mind. Russ, Max and I are in agreement on this: What's going to take your company down is not what you're going to incorporate into your risk model. When you think about all the difficulties companies have had over the past few years, those events were not in your models. It's not going to show up in risk management modeling; it's going to show up as over concentration in particular exposures, legal exposure, something your agents did, suitability, etc. That's why people talk about enterprise risk management.

To manage operational risk, we have to set our models aside. Just remember, at the end of the day, our duration mismatch isn't what will take us down. Over concentration in seven-day puts, or having a 20% position in below-investment-grade bonds, will do it. That has nothing to do with modeling; that has to do with managing risk from an enterprise perspective. The other thing is, and it keys off of the things that both Max and Russ said, that there is value to these models. The name of the game is gaining a competitive advantage by using the models, the technology, and the academic thought that we bring to the table because at the end of the day, that's how you win the game.

From a historical perspective, we've measured interest rate risk, and we've gotten pretty good at it. We've even calculated duration. Our CEOs still don't know what it means, but that's OK, we still present it to them. We've spent a lot of time doing ad hoc line of business studies. The results are brought to management, and management really doesn't understand because you're not presenting them with a total company view. We haven't really provided our management with good information. We always prepare it in terms of a long-term horizon, such as surplus, 30 years from now. How many people think their CEO really cares? How many people have a CEO that's going to be CEO 30 years from now?

On a comparative basis, the banks don't have it right either, even though they've got a banking CEO who wants to see his risk position every day. He doesn't understand value at risk anyway, but they do take a broader view of risk. They don't really incorporate their liabilities as some of the bigger banks do. They have a horizon that's less than one year.

Where are we headed? I think we have to implement a broader-based risk management program. As Russ said, it has to be holistic and it has to be a disciplined process. You can't talk duration. How many people believe that if you talk to management about this year's GAAP earnings, they'll pay attention? You've got to provide management with good information. You've got to give them utility, it goes to Russ's discussion about what-if capability. At least in my perspective, you need to talk to them in terms of discrete time horizons. Thirty years is good, you need to work with that number. But that's not the number you really want to focus on. What happens in between those other 29 years? You could be bankrupt. You could be out of business. What's going to drive us there? All the obvious things will drive us there. We're consolidating, we're demutualizing, and we're converging. We've got shareholders who want 20% growth in share price. It's not getting any easier to compete. The technology is going to allow us to get there.

In terms of the risk elements, you could categorize them many ways. I see them in four parts. There's financial risk, things that we're more comfortable with. The important thing is to make sure that your process focuses on the three that don't say financial. They are business, operational, and event risk. The risk management process in most organizations should spend more time on these three. At the end of the day, it's descending on an organization and looking under every rock, and understanding what's going on in that business. You need to understand how they've constructed their contracts, how they distribute their products, and then to be able to identify what the exposure is. Generally, if you can identify whether it's a market conduct issue, some sort of legal exposure, or some over concentration exposure, you can quantify the severity. The big problem is the frequency issue. But if you can quantify the severity, you can go and talk to management about it. As far as exposure, somebody could show up and say, "My premium didn't vanish." We might have a problem. I firmly believe that those kinds of issues could have been addressed in advance, had we had good risk management processes.

For financial risk management we're going to examine all financial risks. We're going to do it holistically. We're going to assign risk attribution. We're going to define each of our risk elements in some statistical fashion. This is keying right off of some of the things that Russ said. We're either going to rely on historical experience or our expectations for the future. Why? Because it's going to help us make better decisions. I'm going to walk you through a situation and we're going to make the decision.

Consider this simple exercise. There are three liabilities, bank CDs, variable annuities, and universal life (UL). This is a converged company, so it's got a bank. It has corporate bonds and mortgages on the UL side and the bank CD is backed with mortgage pass-throughs, (which you wouldn't normally do). What are our risk elements? Interest rate, credit, lapse, equity markets, or basically sub-accounts inside the variable annuities, and mortality. We're going to use an earnings-at-risk framework. I'll define that in a second, if you're not familiar with it, and we're going to use horizons of 1, 5, and 10 years. We're going to talk to management about risk exposure over those timeframes. Everyone of these risk elements is now defined by some sort of stochastic or dynamic process.

Earnings at Risk (EAR)

The metric here we're going to define as earnings at risk over a five-year horizon. We run 1,000 scenarios. For every scenario, there are five years of distributable earnings. For each scenario, we just add them up. We don't discount them, we don't accumulate them, we add them up. We rank order them. The earnings at risk is the difference from the mean and whatever point in the distribution you want to define as where you want to focus on risk. In this example, we choose the fifth percentile risk exposure. You can pick different points in the distribution to measure the exposure amount.

When you go to management, you say, "Look, we've got a 5% chance we could lose this much in cumulative earnings over a five-year period." Management can sit there and divide by five. After they do the division, they will think they can't afford to lose that much in earnings. They can't afford to have a 5% chance that they could lose that much in their earnings base. You're going to give them the

information: the kind of market environment over the five years, or the kind of dynamics over the five-year period that's going to produce this result. They will sit there and say, "It'll never happen." But at least they understand they have made a decision about how much risk they want to take.

In the work that we've done, when we tell management this, they say, "Oh, too much risk. Get rid of it." Then we come back and show them a presentation that says, "Here, we took out all the risk, and we moved the mean way down." Then they say, "No, you can't move the mean down, got to keep the mean high. Well, maybe this isn't too much risk after all." But as funny as that story sounds, it's true. I've lived it. It's a wonderful process because it helps them create perspective, and it's consistent with both what Max and Russ were talking about.

Now, let's talk about the stochastic elements and the way we modeled them in the example. For a robust scenario generation, we have our own interest rate generator. We're using a capital asset pricing model (CAPM) approach to developing variable annuity sub-account returns. You can model any asset class; large cap, small cap, bond, etc. We use a mean and variance for each of those sub-accounts based on historical results, resulting in a risk premium over the short rate. Using a correlation matrix we end up with correlated debt/equity returns across the sub-accounts.

We can debate this one for a long time as to how you should do dynamic or stochastic credit, but just for the purposes of this exercise, we fitted distributions to historical default experience. As you would expect, they tend to be fairly significant in terms of severity, but very low frequency. So you end up with some pretty interesting distributions.

During this exercise we had a little fun, in terms of any risk dynamic, there's systematic and non-systematic risk, so we built both systematic and non-systematic risk into the mortality. In one context, we're just worried about statistical variance of claims. In the other context, we have some sort of probability of long-term mortality deterioration. The question is, What is the likelihood that it will occur?

For lapse, we're just looking at statistical variation about base lapse. In more sophisticated modeling, you can worry about having a base lapse assumption that may be wrong. Build a dynamic process similar to what Russ did. The dynamic process asks, "What's the probability that my lapse dynamic could be much different than what I'm assuming, and how is that going to impact my risk profile?" For our example, we just did statistical variations.

Let's look at Table 1 for some results for the UL line, using a five-year earnings projection with no discounting or accumulation. Let's start with the totals column, and this is just a rank ordering, a numerical presentation of first percentile to the hundredth, and not necessarily equal increments. The mean value is 12.1, which is different than the 50th percentile, which is 14.

Table 1
FRM Case Study – UL Results (5 year)

Percentile	Total	Lapse	Credit	Mortality	Interest
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

In the first percentile, you lose money. You may have scenarios where you're up against the minimum guarantee, or you've got some high interest rate scenarios. You either have high lapses because you didn't keep pace on the crediting rate side, or you're subsidizing a crediting rate to keep the business in force, or something in between. The risk amount that is the earnings at risk is, in this case, the mean (12.1) minus the fifth percentile (1.6), and resulting in a 10.5 EAR exposure over a five-year horizon. In producing this column, everything was stochastic — mortality, interest rates, and all the elements that we had talked about.

Now let's examine the columns labeled interest. To get this information, we shut the stochastics off for all risk elements except for interest rates. The lapse, credit, and mortality were baseline, but interest rates were stochastic. Then we used baseline interest rates, credit and lapse, and had mortality stochastic, and so on. We end up with a mean, and an exposure amount, for each of the risk elements.

Let's talk about these results. The first thing we observed is that if I added up the independent determination of earnings at risk for each of the different risk elements, I end up with a value of 21, but when I run them on a fully-integrated basis, I end up with 10.5. The fact of the matter is, when you have a credit event, a mortality event, or a lapse event, it's not necessarily the same time you're having an interest rate or other event. They don't happen at the same time. Mortality is totally uncorrelated with interest rates, at least, I'll make that statement and then you can challenge me later. At the end of the day, the difference between the 10.5 and the 21 is the impact of not having fully correlated risks. This gets to some of the information that Russ was talking about. What's interesting is that the interest rate risk exposure is larger than the total exposure. The other observation is that most of the risk is coming from interest rate risk, but mortality isn't that far behind. Of course, it's a function of the way we structured the example. I think you can argue with me that I probably didn't do justice to lapse, but it gives you an idea of how you can generate and use this information. You can start talking to management about, maybe over a five-year period, taking a little more credit risk. Maybe you want to consider mortality reinsurance, if you're really concerned about long-term trends in mortality.

Now let's look at the results for each of the three lines of business. In Table 2, we can see the VA line has a material equity market exposure. The bank CD product line has interest rate exposure. The uncorrelated total is 40.2, but when you get

done factoring in the effect of the correlation effect across the product line and risk elements, you end up with a total exposure of 17.3. Interest rate risk is still the largest risk exposure, but equity market risk is the second largest. It's not always the case that when you're in the tail of the distribution, that the same scenario will generate material risk exposures for the VA and UL line. I'm explaining this because I'm going to make a point a little later on.

Table 2
FRM Case Study

Risk Element Contribution	UL	VA	CD	UnCor.	Cor. Effect	Cor. Total
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		8.1
Uncorrelated Total	21.0	15.2	6.2	42.4	(2.2)	40.2
Correlation Effect	(10.5)	(2.6)	(0.1)	(13.2)		(22.9)
Correlated Total	10.5	12.6	6.1	29.2		17.8

Then we do the same exercise over 1 year, 5 years, and 10 years in Table 3. Equity is a bigger proportion of the overall exposure over a one-year horizon. There is a similar result for credit. What does that tell me? Maybe I want to do something to hedge out my one-year credit exposure. Maybe I want to take more credit risk, because over the long term, it's not going to hurt me. That is one of the key observations. Otherwise, it's interesting that if you divide by 5 and 10, you're going to get annualized exposures that are pretty close, between 3.5 and 4.

Table 3
Financial Risk Management Case Study

Risk Element	EAR(1)	EAR(5)	EAR(10)
Interest Rate	\$1.6	\$16.1	\$38
Equity	3.6	13.1	31
Credit	1.1	2.1	2
Lapse	0.0	0.9	5
Mortality	<u>1.5</u>	<u>8.1</u>	<u>17</u>
Uncorrelated Total	7.8	40.2	95
Correlation Effect	(4.0)	(22.9)	(58.8)
Correlated Total	3.8	17.3	36

Let's consider how you can effectively use this methodology. The original in force mix had UL at \$500, VA at \$800 which included 5% roll-up GMD, and bank CDs at \$500. Then we changed the business mix, but nothing else. When we changed the business mix, UL was at \$400, VA at \$1,300, and bank CDs were at \$100. This transition looks like the transition that the industry's gone through over the past decade or so, moving into the variable products and less into the general account products.

When studying the results of this transition, you want to look at all the details, as in Table 4. The key is, at the end of the day, what happens to the overall risk exposure. There is more equity risk on the balance sheet and a little less interest

rate risk. There is about the same exposure for credit and lapse and a little less for mortality. But interestingly enough, overall earnings at risk exposure is about the same.

Table 4
FRM Case Study (Mix Variation)

Risk Element Contribution	UL	VA	C	UnCor.	Cor. Effect	Holistic	Co-Variance
Interest Rate	\$ 8.5	\$ 2.1	\$ 1.2	\$ 11.8	(\$0.4)	\$ 11.4	\$16.1
		\$21.3		\$ 21.3		\$ 21.3	\$13.1
Credit	\$ 1.7			\$ 1.7		\$ 1.7	\$ 2.1
Lapse	\$ 0.4	\$ 1.0		\$ 1.4	(\$0.2)	\$ 1.3	\$ 0.9
Mortality	\$ 6.2	\$ 0.3		\$ 6.6		\$ 6.7	\$ 8.0
Uncorrelated	\$ 16.8	\$24.7	\$ 1.2	\$ 42.	(\$0.6)	\$ 42.3	\$40.2
Total							
Correlation Effect	(\$ 7.1)	(\$ 4.2)	(\$0.1)	(\$11.3)		(\$24.4)	(\$22.9)
Correlated Total	\$ 9.7	\$20.5	\$ 1.2	\$ 31.4		\$ 17.9	\$17.3

The key is that the expected value has decreased dramatically and the risk exposure amount has remained the same as shown in Table 5. This goes to Russ's point about managing a mix of business and to the extent that you can help management understand that by aggressively growing one line of business and going with the distribution flow has value consequences. Consider what happens to the tail of the distribution. You go from being in a position to never go negative on your earnings at risk exposure over a five-year horizon, to having a tail scenario that can really hurt you. It's a consequence interjecting all that equity exposure and volatility and the impact it has on return, as well as the secondary impact of the guarantees on the equity-based products.

Table 5
Percentile Distribution

Percentile	New Mix Value	Original Mix Value
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	25.2	34.7
Mean - 5 th	17.9	17.3

Now let's look at risk adjusted value, which is the present value of distributable earnings on a risk-adjusted basis. In doing the calculations, you can risk-adjust a number of things. You can risk-adjust the earnings, the capital, or the discount rate. In our example, we're going to risk-adjust through the discount rate. Let's suppose I have two product lines, equity-indexed annuities and variable annuities. I calculate a mean internal rate of return (IRR) and I do some stochastic pricing. The VAs produce a 14.9% expected return, the equity-indexed annuities, 13.3%. If you could only sell one of the two products, how many people want to sell the VA? Everybody, how many people want to sell the equity-indexed annuities? No one, that's interesting.

Now we consider the standard deviation of the IRR. The equity-indexed annuity is 7.8%, and the VA is 12.4%. The aggregate path IRR for equity-indexed annuity is 11.8% and the VA is 15.1%. How many people still want to sell the VA? Now consider the 10th percentile and the 5th percentile IRRs, and the return expectation for the VA is negative ((0.4%) and (7.0%) respectively) whereas the equity-indexed annuity is positive (6.0% and 5.3%). How many people still want to sell a VA product? Two, three, there were about 30 before. Using a CAPM process, you examine the correlations across the different product lines, treating the company as the market.

Table 6
Value Optimization (Example)

	EIA	VA
Mean IRR	13.3%	14.9%
Standard Dev. of IRR	7.8%	12.4%
Average Path IRR	11.8%	15.1%
10 th Percentile	6.0%	(0.4%)
5 th Percentile	5.3%	(7.0%)
Hurdle Rate	9.9%	15.3%
Risk Adjusted Value	\$53.1	(\$0.9)

The resulting covariances, are used to develop Betas, that gets you to a hurdle rate for the different product lines. Not surprisingly, the VA line has a risk adjusted discount rate of 15.3% and is the riskier product line. Therefore, it has a higher required discount rate relative to the equity-indexed annuity line at 9.9%, which has less relative risk. Maybe the company's hurdle rate overall is 12%. At the end of the day you discount the distributable earnings using the different hurdle rates, and the VA line produces a negative value of (\$0.9), the equity-indexed line produces a fairly substantial positive present value of distributable earnings of \$53.1. How many people want to sell the variable annuity product?

Mr. Allan Brender: I'm just curious, how did all this relate to dynamic financial condition analysis? It sounds like the same thing in a way, except for the formalities of how you presented it. It sounds like you are finally in a position to do it. Is this part of your plan?

Mr. Osborn: Yes, these are the same models we're using for dynamic financial condition analysis (DFCA). They are the same models.

Mr. Brender: But, do you intend to have a regular process of actually going to the board and reporting, like a DFCA client would report?

Mr. Osborn: Yes. That's built into the process because we're going to do that on a line-by-line basis annually, just to validate the line's models. They're going to see this analysis at least quarterly at first. They are going to see the S curve and the projections of distributions of earnings and surplus. We're viewing it as more of strategic value than of meeting some regulatory right.

Mr. Sabatini: Yes, I think the solvency question is more off, you're indirectly addressing it, and you are accomplishing that objective, although it's probably not the primary purpose.